THE LANDMARK *SPACE AGE* THUCYDIDES:

HUMAN SPACEFLIGHT IN THE STATE GRAND STRATEGIC QUEST TO ADDRESS FEARS, ADVANCE INTERESTS, AND GARNER HONOR

By

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APPROVAL

The undersigned certify that this thesis meets master's-level standards of research, argumentation, and expression.

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DISCLAIMER

The conclusions and opinions expressed in this document are those of the author. They do not reflect the official position of the US Government, Department of Defense, the United States Air Force, or Air University.

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Major Randel Gordon was commissioned from the United States Air Force Academy at the top of his class in May of 1998 with a Bachelor of Science degree in Aeronautical Engineering. His first assignment was at Laughlin AFB as a student in Specialized Undergraduate Pilot Training (SUPT) in August of 1998. He was the Distinguished Graduate of class 99-13 at Laughlin and received his Pilot rating in August of 1999. Upon graduation of SUPT, Major Gordon was assigned to the Introduction to Fighter Fundamentals (IFF) course at Columbus AFB, MS where he graduated as the Distinguished Graduate and Air-to-Air Top Gun of his class. Following this assignment, he was assigned to Tyndall AFB to become an F-15C Eagle fighter pilot. He was subsequently assigned to the 19th Fighter Squadron and 3rd Operational Support Squadron at Elmendorf AFB AK where he received numerous awards for flight leadership and officership. Major Gordon was accepted to the Air Force Institute of Technology (AFIT) in 2004 to study advanced aerospace concepts and graduated with a Masters degree in Aeronautical Engineering in 2006. His graduate Thesis was awarded the AFIT Dynamics Thesis of the year. Major Gordon also attended the USAF Test Pilot School from 2005 to 2006. There, he graduated at the top of his class and was assigned as a developmental test pilot for the 40th Flight Test Squadron at Eglin AFB. While at Eglin AFB, Major Gordon was qualified to fly the F-15C, F-15E, A-10A/C, and BD-700 Global Express Business Jet. He is currently assigned as a PhD student of strategy at the Air Force's School of Advanced Air and Space Studies (SAASS).

Major Gordon is a Senior Pilot with over 2200 hours of flight time and over 450 hours of combat over Iraq and Afghanistan. He has been married for 11 years. He and his wife are proud and loving parents to a seven-year-old son.

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Scaled Composites, Virgin Galactic Special Projects, XCOR, SpaceX, and Lockheed Martin Orion who so gracious volunteered their time and expertise to be interviewed by me for this research. Everyday, these groups perform amazing miracles in their quest to, "slip the surely bounds of Earth and touch the face of God." I was simply overwhelmed by their professionalism and passionate love of space. As the United States reflects upon the final flights of the amazing Space Shuttle program, the nation can also celebrate the tremendous future and hope provided by these organizations in advancing the saga of human spaceflight. America's spacepower leadership is far from over.

Finally, I would like to dedicate this Thesis to the astronauts and cosmonauts who have given their lives in humankind's quest to explore and utilize the reaches of space. Indeed, our future as a species lies as much "out there" as it does here on Earth. May we always honor their sacrifice.

In Memoriam – *Ad Astra* (To The Stars)	
Mission	**Crew**
Training (23 Mar 61)	Valentin Bondarenko
Training (31 Oct 64)	Theodore Freeman
Training (28 Feb 66)	Elliot See, Charles Bassett
Apollo 1 (27 Jan 67)	Gus Grissom, Edward White II, Roger Chaffee
Soyuz 1 (24 Apr 67)	Vladimir Komarov
Training (5 Oct 67)	Clifton C.C. Williams
Training (8 Dec 67)	Robert Lawrence
Training (27 Mar 68)	Yuri Gagarin
Soyuz 11 (30 Jun 71)	Georgi Dobrovolski, Vicktor Patsayev, Vladislav Volkov
STS-51L (28 Jan 86)	Dick Scobee, Michael Smith, Greg Jarvis, Christa McAuliffe,Ronald McNair, Ellison Onizuka, Judith Resnik
Training (11 Jul 93)	Sergei Vozovikov
STS-107 (1 Feb 03)	Rick Husband, William McCool, Michael Anderson, David Brown, Kalpana Chawla, Laurel Clark, Ilan Ramon

ABSTRACT

Laymen and space enthusiasts alike continuously ask, “Why send people to space?” The popular philosophic answer to this question is, “Because the human race is inspired by other humans exploring the unknown.” While this may be true, by itself it rings cavernously hollow in the face of tough budgetary and political realities. From a state perspective, something of greater beneficial substance must be at play in order to justify the high costs and risks associated with human spaceflight. Extensive studies exist to demonstrate the strategic significance of uninhabited spaceflight technologies, such as the Global Positioning System, or communications and surveillance satellites. However, a dearth of equivalent research exists for human spaceflight. As a result, society too often caricatures human spaceflight as an expensive state luxury with little public importance. In reality, the saga of space history is testament to human spaceflight’s use by states as a powerful grand strategic tool of hi-tech statecraft.

To help remedy this dearth of understanding, this study will use Thucydides’ state power concepts of fear, interest, and honor as an analytical framework to illuminate important linkages between human spaceflight and state goals. Key episodes in the story of American, Russian, and Chinese human spaceflight are studied to highlight the dominant role of fear, interest, or honor as a shaper and motivator of space development. These case studies are useful as they help to extract important grand strategic lessons. These lessons then form the basis of a viable human spaceflight strategy to enhance overall American spacepower and insure the space leadership of the United States for the future in the face of rising competition and dwindling resources.

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Introduction

POYEKALI!

When they saw me in my space suit and the parachute dragging behind me, they backed away in fear. I told them, 'don't be afraid, I am a Soviet like you, who has descended from space and I must find a telephone to call Moscow.'

Major Yuri Gagarin, 1961

The sprawling Baikonur Cosmodrome, located along the barren steppes of Kazakhstan, is forever enshrined as the place where humankind first left Earth to touch the stars. As dawn broke on the morning of 12 April 1961, the Baikonur Cosmodrome was awash in frenetic activity.[1] Clad in a bright orange pressure suit and white helmet emblazoned with the letters CCCP above the visor, 27-year-old Red Army Senior Lieutenant Yuri Gagarin waddled across the launch pad complex.[2] He was surrounded by a small horde of Politburo members and space program officials. Lieutenant Gagarin left the crowd behind as he slowly scaled the launch gantry steps towards his awaiting spacecraft. In the crowd below, Sergei Korolev, the shadowy Chief Designer of the Soviet rocketry program, fidgeted in nervous anticipation of the events about to unfold.[3] Korolev knew that a man's life and the entirety of the Soviet

The Huntsville Times

Man Enters Space

'So Close, Yet So Far,' Sighs Cape

U.S. Had Hoped For Own Launch

Hobbs Admits 1944 Slaying

Soviet Officer Orbits Globe In 5-Ton Ship

Maximum Height Reached Reported As 188 Miles

VON BRAUN'S REACTION:

To Keep Up, U.S.A. Must Run Like Hell'

Figure 1: The Flight of *Vostok* 1 caused a Tectonic Shift in Geopolitics

Source: "Yuri Gagarin in Space," *NASA*, http://www.ibtimes.com/articles/133020/20110411/yuri-gagarin-space-nasa.htm (Accessed 14 April 2011).

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[1] Nicholas L. Johnson, *Handbook of Soviet Space Flight: Vol. 48* (San Diego: CA, Univelt, 1980), 33.
[2] William E. Burrows, *This New Ocean* (New York: NY, Random House, 1999), 311.
[3] James Schefter, *The Race* (New York, NY: Doublesday, 1999), 9.

Union's glory was about to ride on his engineering judgment and expertise.

Atop the launch pad that morning was an R-7 intercontinental ballistic missile; modified to carry a human to Earth orbit instead of a nuclear weapon to Washington DC.[4] Gagarin squeezed inside the cramped confines of his *Vostok* (The East) capsule, was carefully sealed inside by launch technicians, completed all pre-flight checks with launch control, and patiently awaited his destiny. As the countdown reached zero at 9:06 am local time, the R-7 roared off the Baikonur launch complex atop a pillar of crackling flames.[5] An excited Gagarin exclaimed "*Poyekali* (Let's go)!"[6] Several minutes later, *Vostok* 1 slipped gracefully into orbit thereby giving Gagarin the immortal distinction of Earth's first human star voyager. By the time he parachuted into a farmer's field near the Volga River approximately two hours after launch, Soviet leadership in Moscow had ceremoniously promoted Gagarin to the rank of Red Army Major.[7] Korolev was overjoyed.

In the pages of history, the successful mission of *Vostok 1* was an undisputed technological, cultural, and political bonanza for the Soviets. The Soviet Union's accomplishment in space catapulted the nation into the vanguard of global prominence. With it, the age of human space flight as a tool of state grand strategy arrived with momentous fanfare. As such, human spaceflight became another arrow in the quiver of realist-based geopolitics; an international relations concept enumerated as early as the fifth century BCE.

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[4] David M. Harland, *The Story of Space Station MIR* (Chichester: UK, Praxis, 2005), 2.
[5] Ken Kremer, *Universe Today* ,11 April 2011, http://www.universetoday.com/84738/yuri-gagarin-and-vostok-1-photo-album-50th-anniversary-of-human-spaceflight/ Accessed 11 May 2011).
[6] William E. Burrows, *This New Ocean*, 311.
[7] James Schefter, *The Race* (New York, NY: Random House, 1999), 135.

The Space Age Thucydides Model

In his seminal work on the Peloponnesian Wars, Thucydides, an ancient Greek general and historian, described the whole of state power as resting upon the foundations of fear, interest, and honor.[8] In Thucydides' model, fear drives a state to preserve and protect its existing power against the menace of existential threats.[9] Interest is analogous to a state's relentless pursuit of benefit, advantage, or profit as a means to enhance the reach of power beyond existing capabilities.[10] Honor is the measure of a state's relative prestige and ideological potency as understood by both its domestic citizenry and other international state actors.[11] Taken together, these three factors synthesize to become a measure of a state's overall power. By definition, well-protected, highly developed, and prestigious states are more powerful than states deficient in these qualities. With power, nations rise as recognized leaders on the world's stage, advance the forefront of global influence, and are far less likely to succumb to rival state authority challenges. Thus, aggrandizing state power becomes the ultimate prize in the turbulent arena of *Realpolitik* based international relations.[12] Under this model, technological prowess becomes an

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[8] Robert B. Strassler, *The Landmark Thucydides* (New York, NY: Free Press, 1996), 43.
[9] Robert B. Strassler, *The Landmark Thucydides.* Although Thucydides never provides explicit detail about his precise definition of fear as a motivator of state relations, he repeatedly uses the word fear to describe the implicit atmosphere of extreme tension, distrust, and duress that drove military conflict between Athens and Sparta. The definition of fear used for this Thesis, i.e. protection from loss, is therefore the author's interpretation of Thucydides' intent.
[10] Robert B. Strassler, *The Landmark Thucydides.* In his work on the Peloponnesian Wars, Thucydides uses the term "interest" to describe efforts by either Sparta or Athens to extend political power and grow regional influence against the enemy. Hence, from the author's perspective, rather than simply protecting states from the loss of existing power, interest seeks to aggrandize more power then what currently exists.
[11] David Kagan, *The Peloponnesian War* (New York, NY: Penguin Publishing, 2003), 46.
[12] Everett C. Dolman, Astropolitik: Classical Geopolitics in the Space Age (New York, NY: Frank Cass Publishers, 2002), 156.

important buoy to keep afloat all efforts by the state to address fear, interest, and honor.

For instance, the Roman Empire dominated ancient civilizations partly because of its advanced road-building acumen.[13] Technologically superior sea-faring nations, such as Great Britain, enjoyed tremendous dominion because of the ability of their ships to reach any corner of the world.[14] In modern times, the quest for global power and leadership is increasingly sailed upon the new ocean of space. As evidenced by the world's mounting technological reliance on the medium of space for vital peace and wartime functions, spacepower is as significant to a state's international leadership today as land and sea power expertise were in molding the foremost nations of the ancient world.

However, due to a complex nexus of factors, basic exploitation and access to the medium of space is significantly different from the utilization of terrestrial based domains. Tremendous difficulties in achieving state harmony across the continuum of facilities, industry, hardware, economy, education, geography, culture, intellectual climate, and populace support make the development of space faring capabilities the dominion of only a few nations.[15] Fewer still have these skills and resources in sufficient quantity to join the highest echelon of spacepower states; those that posses an indigenous human spaceflight program. For the United States, Russia, and China, currently the only states to occupy this top stratum of space faring, overcoming the staggering barriers inherent in achieving human spaceflight reflect each nation's deep commitment to use hi-tech statecraft with respect to Thucydides' concept of power. This phenomenon also opens a

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[13] Gary Forsyth, *A Critical History of Early Rome: From Prehistory to the First Punic War* (Berkeley, CA:University of California Press, 2006), 309.
[14] Alfred Thayer Mahan, *Classics of Sea Power* (Annapolis, MD: Naval Institute Press, 1991) 31-62.
[15] James Oberg, *Space Power Theory* (Colorado Springs, CO: US Air Force Academy) 44.

fascinating research opportunity to investigate the saga of human spaceflight from a unique geostrategic perspective.

In actual practice, the concepts of fear, interest, and honor continuously interact in an intricate symbiotic relationship. With rare exception, state efforts to acquire power are typically motivated by a confluence of these three factors. However, the previous 50 years of human spaceflight demonstrate how sweeping changes in geostrategic context can cause one of these factors to rise in great prominence with respect to the other two factors. As such, individually abstracting the impacts of fear, interest, and honor on the development of human spaceflight is an immensely powerful theory model. This approach is useful for a spacepower strategist as it helps to clarify how the broader geostrategic context shapes state efforts to build human spaceflight capability, affects a human spaceflight program's success or failure, and ultimately defines how human spaceflight contributes to the overall achievement of state goals.

While extensive studies exist to demonstrate the strategic significance of uninhabited spaceflight technologies, such as the Global Positioning System, or communications and surveillance satellites, little equivalent research exists for human spaceflight. As a result, society too often caricatures human spaceflight as an expensive state luxury with little public importance beyond trite references to Velcro©, Tang© breakfast drink, or thrilling science fiction media.

Laymen and space enthusiasts alike continuously ask, "Why send people to space?" The popular philosophic answer to this question is, "Because the human race is inspired by other humans exploring the unknown." While this may be true, by itself it can ring cavernously hollow in the face of tough budgetary and political realities. From a state perspective, something of greater beneficial substance must be at

play in order to justify the high costs and risks associated with human spaceflight.

To help remedy this dearth of understanding, this study will use Thucydides' concepts of fear, interest, and honor as an analytical framework to illuminate important linkages between human spaceflight and state goals. Key episodes in the story of American, Russian, and Chinese human spaceflight are studied to highlight the dominant role of fear, interest, or honor as a shaper and motivator of space development. These case studies are useful as they help to extract important grand strategic lessons. Understanding these lessons is of special contemporary important for the United States as recent tectonic shifts in the political and economic environment have caused America's current human spaceflight program to reach an unprecedented crossroad. To a much greater extent than at any other time in spaceflight history, the future viability of America's space efforts hinge on the crucial strategic decisions made by today's national leadership. The analysis conducted for this research forms the foundational basis for crafting a human spaceflight strategy designed to enhance the strength of America's overall spacepower. Only through a concerted and serious strategy designed to leverage the emerging partnership between government and commercial human spaceflight can the United States effectively maintain space leadership for the future.

Thesis Chapter Overview

While all three of Thucydides concepts are continuously in play in geopolitics, Thucydides' notion of fear and honor truly dominated thinking during the early era of the space race. Chapter 1 traces the lineage and impact of honor in both the space programs of the free and communist worlds. The chapter begins with a study of both the Russian and American cultural approaches to aerospace technology

during the birth of flight. Understanding these beliefs is important as they play a crucial role in shaping the foundation for spaceflight development. By the time of the early 1960s, the Soviet Union and the United States were firmly embroiled in a Cold War struggle for global hegemony. In his famous 1962 speech, President John F. Kennedy pledged the moon as a space program objective for the same reason men climbed high mountains, flew across the Atlantic, or, he jokingly, added why Rice played Texas.[16] For him, a space race to the moon was an intentionally difficult objective that would become the most visible symbol of a high stakes ideological competition.[17] Victory in the space race was a matter of demonstrating to the world the superiority of either the Soviet's brand of communism or the West's style of democracy. It was a chance for the Kennedy administration to counter embarrassing political losses to the Soviets over Gagarin's flight and the Bay of Pigs fiasco.[18] The ethos undergirding the Soviet *Vostok*, *Voshkod*, and *Soyuz* programs was the direct analog to the spirit of the US Mercury, Gemini, and Apollo projects. The military cosmonauts and astronauts recruited within these respective programs became space age soldiers on the frontline of a global clash of civilizations. However, with the 1969 triumphal success of the Apollo 11 mission, the luster of the honor path for human spaceflight began to tarnish and the underlying factors behind the nature of the space race changed dramatically.

Commiserate with the start of the space race was a growing, but clandestine, demand for human spaceflight as a tool for national security applications. This resulted in a split path; one well-known path, described in Chapter 1, that emphasized honor via headline

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[16] President Kennedy's Address on National Space Effort, 12 September 1962, http://www.jfklibrary.org/Research/Ready-Reference/JFK-Speeches/Address-at-Rice-University-on-the-Nations-Space-Effort-September-12-1962.aspx (Accessed 15 January 2011).
[17] William E. Burrows, *This New Ocean*, 323.
[18] James Schefter, *The Race, 137.*

grabbing human spaceflight achievements, and one lesser-known path, described in Chapter 2, which focused on addressing national security via piloted strategic military spaceplanes and crewed orbiting battle stations.

Within America, fears of strategic surprise from the Soviet Union drove the United States Air Force to advocate for a military role in human spaceflight. Grandiose visions of spacepower fighters and bombers as the natural extension of their airpower equivalents heavily influenced Air Force strategic thinking.[19] A plan for Dyna-Soar, a sleek, exo-atmospheric, multirole, piloted vehicle, was the natural outgrowth of this geostrategic context.[20] In addition, the Air Force produced designs for a Department of Defense version of the Gemini capsule known as Gemini-B.[21] This highly modified Air Force spacecraft was created to service the Manned Orbiting Laboratory; a proposed military surveillance and command and control space station.[22] Neither program achieved operational status, however, both served to inspire fear in the Soviets to build similar capabilities.

Raketoplan (Rocket Glider) was the Soviet's main response to the Dyna-Soar program.[23] Much like its American counterpart, *Raketoplan* was technologically audacious, geostrategically electrifying, but ultimately economically and politically unsustainable. Like Dyna-Soar, *Raketoplan* never achieved operational spaceflight. However, the Soviets successfully built and orbited three of their celebrated *Salyut* (Salute)

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[19] Bernard Shriver, *Manned Operational Capability in Space*, November 1961.
[20] Steven R. Storm, *Aerospace*, "Jurassic Technology: The History of the Dyna-Soar," http://www.aero.org/publications/crosslink/winter2004/01.html (Accessed 13 April 2011).
[21] William E. Burrows, *This New Ocean*, 255.
[22] William E. Burrows, *This New Ocean*, 255.
[23] Asif A. Siddiqi, *Challenge to Apollo: The Soviet Union and the Space Race 1945-1974,* NASA SP-2000-4408, 231.

stations as secret military platforms.[24] Designated by the Soviets under the *Almaz* (Diamond) code word, these space stations were a direct counter to the proposed US Air Force Manned Orbiting Laboratory.[25] The *Almaz* stations were solely operated by military cosmonauts and featured advanced surveillance equipment for spy missions against the United States.[26] One of the three *Almaz* platforms also featured a 23mm cannon, giving the station the ability to destroy enemy satellites or defend against boarding from enemy spacecraft.[27] These stations represented the pervasive distrust the Soviet government held against the United States.

However, not all human space efforts in the 1970s were warlike in nature. Both the United States and Soviet Union embarked on serious efforts to use human spaceflight as a tool to address national security fears through the fostering of peace. The 1970s dawned with both the United States and the Soviet Union seeking opportunities to thaw Cold War relations. The nuclear stockpiles of both nations had escalated to absurd levels, the Vietnam War was straining US domestic society and power abroad, and the Soviets were fearful of a US-Sino alliance after President Richard Nixon's famous 1972 trip to China.[28] As a result, both the United States and Soviet Union pursued an overarching policy of *Détente* (Relaxation) with arms limitation treaties designed to ease tensions from the brink of nuclear Armageddon.[29] The human spaceflight contribution to *Détente* was the 1975 Apollo-*Soyuz* Test

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[24] Nicholas L. Johnson, *Handbook of Soviet Manned Space Flight*, (San Diego, CA: Univelt, 1980) 213-217.
[25] Nicholas L. Johnson, *Handbook of Soviet Space Flight: Vol. 48*, 213-217.
[26] Philip Baker, *The Story of Manned Space Stations*, 15.
[27] Philip Baker, *The Story of Manned Space Stations*, 51.
[28] Walter A. McDougall, *...The Heavens and the Earth* (Baltimore: MD, John Hopkins, 1985), 422.
[29] Lawrence Freedman, *The Evolution of Nuclear Strategy* (New York:NY, Palgrave, 2003), 338.

Project.[30] Soviet Premier Aleksei Kosygin and President Richard Nixon used this space initiative as a symbolic gesture of good will between their two nations.[31] The famous on orbit handshake between then Air Force Colonel Tom Stafford and then Russian Air Force Colonel Alexei Leonov was a public relations coup.[32]

However, the early 1980s witnessed a return to frigid relations between the United States and the Soviet Union. The 1979 Soviet invasion of Afghanistan, US boycott of the 1980 Olympics in Moscow, revitalized US defense spending, and instability in Russia following the death of Brezhnev all contributed to stolid Cold War attitudes.[33] Amidst dwindling political and economic support, the National Aeronautics and Space Administration (NASA) turned from conducting lunar missions to operating a reusable vehicle to operate in low Earth orbit.[34] The Space Transportation System, commonly known as the Space Shuttle, was a hybrid of civil and Department of Defense (DOD) requirements. For example, the need to accommodate DOD classified payloads drove the dimensions of the Space Shuttle's cargo bay, while technical and budgetary obstacles drove NASA to opt for a partially, vice fully, reusable spacecraft design.[35] Proposing to launch payloads from both the civil and defense sector, as well as estimates of up to 50 missions

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[30] Philip Baker, *The Story of Manned Space Stations* (Chichester: UK, Praxis, 2007), 55.
[31] William E. Burrows, *This New Ocean*, 447.
[32] Rex Hall, Soyuz: A Universal Spacecraft (Chichester, UK : Springer Praxis, 2003), 212.
[33] "Iranian Revolution", *Nova Online*, http://novaonline.nvcc.edu/eli/evans/his135/Events/Iran79.htm (Accessed 18 February 2011).
James Phillips, "The Soviet Invasion of Afghanistan", *The Heritage Foundation*, http://www.heritage.org/research/reports/1980/01/the-soviet-invasion-of-afghanistan (Accessed 10 March 2011).
Pierre Tristan, "The 1980 Olympics Boycott over the Soviet Invasion of Afghanistan", *Middle East Issues*, http://middleeast.about.com/od/afghanistan/a/me080803.htm (Accessed 11 March 2011).
[34] David M. Harland, *The Story of the Space Shuttle* (Chichester, UK, Praxis, 2004), 3.
[35] National Aeronautics and Space Administration, *Columbia Accident Investigation Report*, (Washington, DC: NASA, August 2003), 22.

per year, helped to reduce anticipated program costs.[36] Reality, however, differed wildly from initial program estimates. As a result, the Space Shuttle only performed a few dedicated military missions. The vast majority Space Shuttle missions were for civil and scientific purposes. Cold War tensions, however, made the Soviets view the Space Shuttle as an ominous military space plane capable of delivering a nuclear payload against the Soviet Union or disabling Soviet satellites.[37] As such, the Soviets initiated a crash program to build the *Buran* (Snowstorm) space plane to counter the perceived military capabilities of the American Space Shuttle.[38] Although canceled after only one uninhabited orbital flight, *Buran* was still a stunning achievement of the Soviet space industry. However, *Buran's* breakneck development amidst tremendous Soviet financial and political upheaval highlighted the insatiable grand strategic need of the Soviet Union to match Western capabilities, even if those capabilities were largely non-existent.

Chapter 3 covers the 1980s and post Cold War use of human spaceflight for Thucydides' state power notion of interest. To fulfill this concept, American and Soviet political leadership turned to space stations. For the United States, President Ronald Reagan envisioned the use of Space Station Freedom as an American soft power tool to unite western nations and advance scientific knowledge.[39] For the Soviets, the *Salyut* guest cosmonaut program and space station *Mir* (Peace) were designed to help solidify Soviet political influence over the brotherhood

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[36] David Harland, *The Story of the Space Shuttle* (Chichester, UK: Praxis, 2004), 2-3.
[37] Bart Hendrickx and Bert Vis, *Energiya-Buran: The Soviet Space Shuttle* (Chichester, UK, Praxis, 2007), 54-55.
[38] Bart Hendrickx and Bert Vis, *Energiya-Buran: The Soviet Space Shuttle, 82-85.*
[39] "President Ronald Reagan 25 January 1984 State of the Union Address," *Federalism and the new Conservatism*
"http://reagan2020.us/speeches/state_of_the_union_1984.asp (Accessed 20 March 2011).

of communist nations.[40] These programs also served as a means to generate wealth for the Soviet government. In the 1990s, President Bill Clinton and Russian President Boris Yeltsin shaped the trajectories of their respective space programs to match broader post Cold War administration goals. The United States used the Shuttle-*Mir* partnership to bolster overall foreign policy diplomatic initiatives, while the Russians used it as a tool to extract steep financial gains in order to keep their post revolutionary government legitimate.[41] Similar efforts to advance national interest continue today with the multination consortium involved with the construction and operation of the International Space Station (ISS).

Furthermore, both the ISS and *Mir* have served as destinations for a budding human commercial space tourism industry. For example, in 1990 the Tokyo Broadcasting System paid the Russian government $28 million to fly a Japanese journalist aboard *Mir* for a week.[42] Wealthy businesspeople such as Dennis Tito, Mark Shuttleworth, and Anousheh Ansari paid millions of dollars to the Russian Space Agency for brief flights to the ISS.[43] Space flights of this nature satisfy state interest as they help to generate wealth.

Chapter 4 chronicles the impact of Thucydides' concepts on the growth of Chinese human spaceflight. In 1956, China began its space program primarily as a means to address regional security fears.[44] The US war in neighboring Korea, US support for Taiwan during the Quemoy and Matsu islands incident, and strained relations with the Soviet

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[40] Roger D. Launius, *Space Stations: Base Camps to the Stars* (Washington: DC, Smithsonian, 2003), 101.
[41] William E. Burrows, *This New Ocean*, 605-609.
[42] David Harland, *The Story of the Space Station Mir, 202.*
[43] Anousheh Ansari, *My Dream of Stars: From Daughter of Iran to Space Pioneer* (New York, NY: Palgrave MacMillan, 2010), 96.
[44]Roger Handberg and Zhen Li, *Chinese Space Policy: A Study in Domestic and International Politics* (New York,NY: Routledge, 2007), 57.

Union convinced the Chinese leadership of the need to develop a deterrence capability based on nuclear missile technology.[45] Although Chinese efforts met with some initial success in rocket production and satellite design, the space program was hamstrung by mass poverty, lack of industrialization, and crippling natural disasters.[46] Efforts for a human space program to advance Chinese honor began as early as 1966 during China's Cultural Revolution.[47] However, Chairman Mao Tse-Tung's vicious societal purges further hampered the scientific and industrial base needed to support a modern space program.[48] Although China instituted a serious effort to train and equip for human spaceflight, political, economic, and social turmoil meant that none of the original 19 taikonauts selected from the People's Liberation Army Air Force (PLAAF) ever flew.[49] During the 1980s, the policies of China's Communist Party leader Deng Xiaoping focused on rebuilding Chinese domestic society and economic power following Mao's Cultural Revolution.[50] As such, Xiaoping believed that China had no need to land people on the moon and instead focused on producing and launching uninhabited commercial satellites.[51] Ironically, Xiaoping's steady build-up approach allowed China to construct the technological foundation and operational expertise required for a robust human space program. By the late 1990s, China revived its human space program as a means to advance national interests and honor by symbolically uniting its domestic population, solidifying prestige, and enhancing its

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[45] Campbell Craig, *Destroying the Village* (New York: NY, Columbia University Press, 1998), 52.
[46]Handberg and Li, *Chinese Space Policy: A Study in Domestic and International Politics*. 63.
[47] "Shuguang-1," *Astonautix*, http://www.astronautix.com/craft/shuuang1.htm (Accessed 23 March 2011).
[48] Roderick MacFarquhar and Michael Schoenhals, *Mao's Last Revolution* (Cambridge, MA: Harvard, 2006), 7-13.
[49] Erik Seedhouse, *The New Space Race: China vs. the United States* (Chichester: UK, Praxis, 2010), 13.
[50] Erik Seedhouse, *The New Space Race: China vs. the United States, 15.*
[51]Handberg and Li, *Chinese Space Policy: A Study in Domestic and International Politics*. 84.

scientific prowess.[52] Although an ostensibly civil program through the Chinese National Space Agency (CNSA), the Chinese space program is in reality an arm of the Chinese military and its astronaut corps consists exclusively of officers from the PLAAF.

China designed its modern human space program to leverage previously invented space technologies. This quick generational skip approach is designed to allow China to achieve parity with the United States and Soviet Union despite a four-decade late start. Hence, the mission objectives of the Chinese *Shenzhou* (Sacred Vessel) spacecraft have aggressively grown and the crew sizes have rapidly expanded from one to three taikonauts.[53] As testament to this generational skip approach, on only China's third human spaceflight mission, taikonaut Zhai Zhigang successfully conducted a spacewalk; an accomplishment that took both the United States and Russia eight human spaceflight missions respectively during the 1960s.[54] China has further professed a desire to launch a space station on the next crewed mission and to land taikonauts on the moon during the 2020 to 2025 timeframe.[55] These accomplishments and bold mission statements have made the rise of the Chinese human spaceflight program impressive.

For the United States, this resurgence arrives at a time when the current American human space program is in decline. Contemporary political and economic constraints dictate a new approach to the US space program in order to remain globally competitive. The US Space Shuttle fleet will be retired from service by the end of 2011.[56] In 2010,

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[52]Handberg and Li, *Chinese Space Policy: A Study in Domestic and International Politics*. 137.
[53] "Shenzhou 7," *Astronautix*, http://www.astronautix.com/flights/shezhou7.htm (Accessed 26 March 2011).
[54] Erik Seedhouse, *The New Space Race: China vs. the United States, 193.*
[55] Erik Seedhouse, *The New Space Race: China vs. the United States,* 146-147.
[56] "As Shuttle Nears Retirement, U.S. Weighs Options for Future Space Exploration," *Radio Free Europe*,

President Barack Obama canceled the follow on government space program, known as Constellation, due to extreme cost overruns and schedule delays.[57] As a result, the US government, steeped in technocratic bureaucracy, can no longer be the sole source of national human spaceflight innovations. Instead, America must now increasingly rely on the commercial sector to carry the mantle of the American human spaceflight program. Chapter 5 describes efforts by commercial companies such as SpaceX, XCOR, and Virgin Galactic to broker a new era of commercial human spaceflight. In partnership with NASA, companies within the Commercial Crew Development program will assume operations within low Earth Orbit and resupply missions to the International Space Station.[58] Presumably, NASA will then be able to use its limited resources to develop and fly America's next generation government spacecraft, Lockheed Martin's Multi Purpose Crew Vehicle (MPCV).[59] As currently planned, the MPCV will be the vehicle to take human explorers to new destinations beyond cis-lunar space.

Chapter 5 also details a cohesive strategy to enhance America's future space leadership. Emerging technologies in human spaceflight and changing context in both the political and economic spectrum offer a unique chance to harmonizing US space strategy across ends, ways, and means. Under this new paradigm, the US government will adopt a fast adopter approach. Similar to the interwar Golden Age of Flight from 1920-1939, the US government will use financial incentives, subsidies, and policy to bolster private sector human spaceflight innovations. The

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http://www.rferl.org/content/As_Shuttle_Nears_Retirement_US_Weighs_Options_For_Future_Space_Exploration/1884779.html (Accessed 20 April 2011).

[57]Jonathan Amos, "*Obama cancels Moon return project,*" *BBC Magazine*, 1 February 2010, http://news.bbc.co.uk/2/hi/science/nature/8489097.stm (Accessed 15 January 2011).

[58] "Commercial Crew and Cargo," *National Aeronautics and Space Administration*, http://www.nasa.gov/offices/c3po/home/index.html (Accessed 14 January 2011).

[59] Randy Sweet, Eric Hogan, and Vanessa Aponte (Lockheed Martin), interview conducted by the author, 30 March 2011.

US military and civil space programs will then adapt the most promising of these technologies to suit their needs according to goals described in national space policy guidance. With reliable and relatively low cost access to space, new state applications for human spaceflight capabilities will emerge. This hybrid government/commercial approach will help advance national space infrastructure, reduce launch costs to orbit, and invigorated a space-minded society. In this manner, the US human spaceflight program can continue its use as a tool of national grand strategy. Given today's environment of dwindling state resources, it is the only viable path to preserve US space leadership. NASA administrator Charles Bolden explained this concept best when he stated, "Reliance upon the commercial sector is no longer an option. It is *the*[emphasis added] way forward for the US space program."[60]

[60]USMC Maj.Gen(ret) and current NASA Administrator Charles Bolden, Honorary PhD acceptance speech to Air University, Maxwell AFB, October 2010.

Chapter 1

THE THIRST FOR FIRST

Honor in the early human space race: 1903-1969

The exploration of space will go ahead, whether we join in it or not, and it is one of the great adventures of all time, and no nation which expects to be the leader of other nations can expect to stay behind in this race for space.

President John F. Kennedy, 1962

Thucydides' concept of honor deeply permeated the tumultuous nature of the early human space race between the Soviet Union and the United States. Each nation's conception of honor was a reflection of specific cultural beliefs and largely intertwined with broader themes in the geostrategic context. These beliefs on honor had a profound impact upon each country's view of the interplay between technology and society. As a precursor to the space age, the development of aviation in the early twentieth century serves as a useful foreshadow of the underlying themes of the space race. Understanding the political and cultural dynamics of human spaceflight and the insatiable thirst for first in the space race begins by first examining each state's approach to its early aviators and airplanes.

Daring Aviators, Flying Contraptions, and Utopian Bliss

On the sandy shores of North Carolina, humanity realized an age-old quest. From the fable of Daedalus and Icarus, to the experiments of Otto Lilienthal and Samuel Langley, humans have always dreamed of mastering flight.[1] Orville and Wilbur Wright, two remarkably innovative bicycle makers from Dayton Ohio, brought this dream to reality on 17 December 1903.[2] Preserved for all time in an iconic photograph, the

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[1] Peter L. Jakab, *Visions of a Flying Machine* (Washington:DC, Smithsonian, 1990), 19-30.

[2] Peter L. Jakab, *Visions of a Flying*, 209-211.

flight of the 1903 Wright Flyer from the windswept hills of Kitty Hawk heralded the birth of the modern airplane. During the early twentieth century, nations around the world realized the potential of the airplane to serve as a potent economic instrument, military weapon, and convenient means of transportation. However, as the ultimate technological symbol of humankind's authority over nature, the airplane also possessed transformational qualities that fundamentally altered how societies measured national honor.[3] Within Russia, this distinctive view of the aircraft was especially compelling.

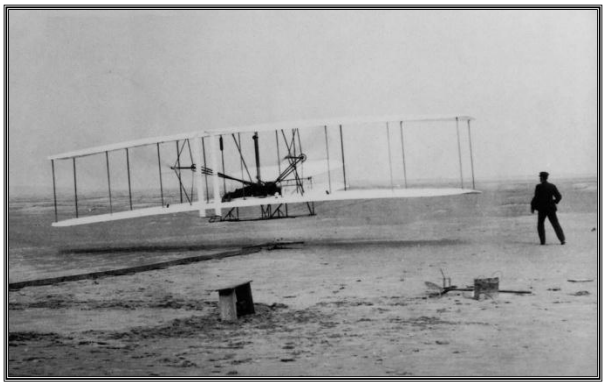

Figure 2: Wright Brothers Liftoff from Kitty Hawk

Source: http://oneclimbs.com/2010/09/05/the-pride-and-prosperity-cycle/ (Accessed 22 April 2011).

For Imperialist Russia, the aircraft was a transcendent symbol of modernization. Czar Nicholas II, keenly self-conscious of his nation's international reputation for backwardness, sought the aircraft as a tool for Russia to, "assume its rightful place as the most cultured and advanced of European states."[4] Russian citizens eagerly joined flying clubs and flocked in the thousands to air shows. For them, the aircraft was a beacon of hope for a better life. By innovating foreign aircraft designs, Russia's fledgling air force became one of the largest in the world prior to World War I.[5] In addition, famed aviation designer Igor Sikorsky garnered international acclaim for Russia by producing the mammoth *Il'ya Muromets* bomber.[6] Named after a mythic Russian

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[3] Scott W. Palmer, *Dictatorship of the Air* (New York, NY, Cambridge, 2006), 1.
[4] Scott W. Palmer, *Dictatorship of the Air*, 282.
[5] Scott W. Palmer, *Dictatorship of the Air*, 66
[6] Scott W. Palmer, *Dictatorship of the Air*, 63

folklore hero, the *Il'ya Muromets* was unrivaled for many years in both size and performance as the world's first four-engine bomber.[7] Unfortunately, these exploits were designed more for headline grabbing attention than for substantive aviation development. The hollowness of the Russian approach to aviation was a key reason for its catastrophic defeat in World War I.[8] Nonetheless, while the Bolshevik Revolution of 1917 ended the rule of the Romanov Czars, it did not extinguish Russia's infatuation with the mystique of the airplane.

Whereas Imperial Russia sought parity with the West, communist Russia under the rule of Premier Joseph Stalin sought total domination.[9] Within this new Soviet worldview, the aircraft was a critical component in establishing a Marxist utopia. State directed modernization for aircraft production would transform Russia from a backwards agrarian society into a powerhouse of industrial might. Mandatory participation in state sponsored aviation societies would force a culture of air-minded citizens willing to sacrifice all to achieve the modernity that aviation promised. The Communist Party leadership lionized Soviet aviators as heroic symbols of self-sacrifice, loyalty, and collectivity. Private entrepreneurship, creativity,

Figure 3: Propaganda Poster Extolling "Mighty" Soviet Aircraft

Source: "XPlanes," http://xplanes.tumblr.com/post/73458433, (Accessed 18 April 2011).

[7] Scott W. Palmer, *Dictatorship of the Air*, 282.
[8] Scott W. Palmer, *Dictatorship of the Air*, 74.
[9] Scott W. Palmer, *Dictatorship of the Air*, 286.

and economically driven innovation were derided by the Soviet's as tools of class oppression.[10]

For a brief period in the 1930s, Soviet aviation experienced extraordinary gains in terms of production and capability.[11] However, the abject poverty, distrust, fear, and widespread brutality spread by Premier Joseph Stalin's purges were increasingly at odds with the promise of modernity through aviation. Towards the end of the 1930s, the Soviet aviation industry wallowed in gross inefficiencies and was becoming increasingly reliant on the West for innovation and support.[12] Stalin hid these truths from domestic and international society by staging widely publicized record-breaking flights as proof of Soviet aviation superiority.[13] Unfortunately, like his Czarist predecessor, Stalin's increasing attention to image over substance would be the downfall of Russian aviation. In the opening years of Operation Barbarossa, Hitler's well equipped and operationally proficient *Luftwaffe* (Air Force) shamed Soviet air power.[14] Hence, this pattern of technological idolatry, irrational idealism, and bold face bluffing formed the patterns of Russian thought with respect to the significance of flight. Russian aviation historian Scott Palmer termed this pattern as compensatory symbolism.[15] Palmer's concept is a critical component to understanding Soviet honor themes with respect to flight and advanced technology.

As with Russia, aviation development in the United States unfurled as a reflection of unique societal characteristics. While the significance of the Wright brothers' invention blossomed quickly in

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[10] Walter A. McDougall, *The Heavens and the Earth* (Baltimore, MD: John Hopskins, 1985), 72.
[11] Scott W. Palmer, *Dictatorship of the Air*, 195-196.
[12] Scott W. Palmer, *Dictatorship of the Air*, 249.
[13] Scott W. Palmer, *Dictatorship of the Air*, 233.
[14] Scott W. Palmer, *Dictatorship of the Air*, 259.
[15] Scott W. Palmer, *Dictatorship of the Air*, 282.

Europe, aviation was slow to dawn in America. Unlike in Europe, where the close proximity of enemy nations drove countries to innovate the aircraft into a weapon, the geostrategic protection afforded by the Atlantic and Pacific oceans drove US officials to view the airplane as a simple curiosity with limited utility. As a result, the US Army possessed only eight aircraft at the start of World War I.[16] In contrast, Russia possessed 190 airplanes.[17] After America's 1917-1918 involvement in World War I, however, the airplane became a fixture of the American military and society. Like the Russians, Americans became fascinated by the wonders of aviation and viewed the aircraft as a technological marvel. However, the lone ethos of the American World War I fighter pilot, coupled with cultural values of freedom and openness, shaped America's approach to flight very differently from that of the Russians.

Fundamentally, US citizens did not bestow aviation with the transcendent power to shift society from misery to utopia. Instead, Americans viewed aviation as a tool for individual progress, financial gain, and adventurous challenge.[18] As military budgets shrank in the post World War I environment, private enterprise assumed the mantle for aviation development.[19] Rather than state controlled development, commercial rivalry between such companies as Curtiss, Vought, and Boeing produced aircraft with successively amazing leaps in performance and flying qualities. American aircraft, pilots, and mechanical crews were a constant presence at international aviation competitions such as the Schneider Cup and Bleriot races.[20] World War I veteran pilots used their skills to foster cultural air-mindedness by becoming barnstormers, opening flight schools, or serving as pilots in

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[16] Lee Kennett, *The First Air War: 1914-1918* (New York, NY: Free Press, 1991), 21.
[17] Lee Kennett, *The First Air War: 1914-1918,* 21.
[18] Scott W. Palmer, *Dictatorship of the Air*, 282.
[19] Walter A. McDougall, *...Heavens and the Earth*, 76.
[20] "Barnstormers and Racers," *Century of Flight*. http://www.century-of-flight.net/Aviation%20history/daredevils/Schneider.htm (Accessed 10 February 2011).

the budding airline and airmail industries. US aviation heroes, such as Charles Lindberg, James Doolittle, and Amelia Earhart, were championed for their independence and daring spirit, not for loyalty or collective sacrifice.

These characteristics of American aviation spawned tremendous advances across the spectrum of aircraft technology. However, by the early 1940s, this free-hand approach to aviation development was quickly becoming inadequate to meet the immediate challenges of wartime production.[21] Within the context of World War II, tighter government oversight of aviation and directed technological innovation became the keys to support Allied victory.

Figure 4: James Doolittle Symbolized the American Aviator Individualist Ethos

Source: "Racers: Jimmy Doolittle and the Perfect Curtis R3C-2 Seaplane," *Airpigz,* http://airpigz.com/blog/2010/7/9/coolpix-racers-jimmy-doolittle-and-the-perfect-curtiss-r3c-2.html (Accessed 23 April 2011).

The American approach to aviation, with its focus on individual spirit, commercial innovation, and minimal government oversight, was in stark contrast to the Soviet approach. Both approaches to aviation had their pros and cons. Soviet style centralized control and execution maximized short-term advancement towards solving a problem, but stifled innovation and encouraged inefficiency. Using this approach, Soviet aviation industry experienced tremendous gains in the early 1930s, but quickly decayed to bureaucratic slough, bluffing, and obsolescence by 1940. America's *laissez-faire* (leave to do) approach fostered tremendous creativity, but hindered organized effort towards a defined immediate goal. These paradigms were deeply entrenched

[21] Walter A. McDougall, *...Heavens and the Earth*, 79.

within the Soviet and American cultures. These patterns of thought and experiences during aviation's Golden Age from the 1920s to the 1930s undergirded both Soviet and American approaches to the emerging space age and had a profound impact upon state honor.

National Approaches to the Space Age

As the embers of World War II smoldered, a mad dash was under way between the Soviet Union and the United States to acquire talent and material from the German rocketry program. The Soviets, inspired by the cosmic futuristic visions of astronautical scientist Konstantin Tsiolkovsky, sought to develop a new class of rocketry weapons.[22] In similar fashion, the work of Professor Robert H Goddard in the United States portended a new age of powerful liquid fueled rockets and space travel.[23] Both nations viewed the V1 and V2 rocket successes of Dr. Werner von Braun's team at Peenemünde as the gateway to achieving their own strategic goals. At the conclusion of World War II, with both the Soviet and the American forces rapidly closing in on German rocket facilities, Dr. Braun willingly surrendered to Allied forces to avoid capture by the Soviets.[24] Braun was debriefed by intelligence officials, transferred to the United States, and eventually became the technological mastermind behind the American rocket program. In the Soviet Union, Sergei Korolev, a brilliant aerospace engineer imprisoned by Stalin during World War II, consolidated the remaining elements of

Figure 5: Dr. Werner Von Braun, Father of the American Space Program

Source: NASA Marshall Space Flight Center, "Von Braun and Walt Disney," *NASA*, http://history.msfc.nasa.gov/vonbraun/disney_article.html (Accessed 24 April 2011).

[22] Walter A. McDougall, *…Heavens and the Earth*, 19.
[23] Walter A. McDougall, *…Heavens and the Earth*, 76-77.
[24] William E. Burrows, *This New Ocean*, 116.

the German missile program and became the Chief Designer of Soviet rocketry.[25] With the chessboard for the space race set, established cultural norms and values evident from the Golden Age of flight shaped each country's approach to the new space age.

The Soviet Union continued its dogmatic adherence to state controlled innovation. Known as the technocratic approach, this style hinged on the belief that the function of the state should be, "transformed from one of political rule over men into a scientific administration of things and a direction of processes of production under scientific management."[26] Following the death of Stalin, Premier Nikita Khrushchev assumed power and swore a new era of de-Stalinization.[27] Khrushchev promised a return to Leninist style communism and an emergence from the dark days of Stalin's rule. Similar to how his predecessors viewed the airplane, Khrushchev saw the rocket as the technological means with which to transform Soviet society into utopia and garner honor. Khrushchev, while brash and sometimes erratic, was a master showman who understood the power of propaganda to accomplish state goals. While he did not understand rockets, he understood the political, military, and psychological significance of being the first nation to conquer the new high ground of space.[28] In his view,

Figure 6: Sergei Korolev, the Soviet Union's Chief Designer

Source: "Space Hall of Fame," *New Mexico Space Museum*, http://www.nmspacemuseum.org/halloffame/images.php?id=15 (Accessed 26 April 2011).

[25] James Schefter, *The Race* (New York, NY: Doubleday, 1999), 9.
[26] Frederick Engels, "Socialism: Utopian and Scientific", *Marxists*, http://www.marxists.org/archive/marx/works/1880/soc-utop/ch01.htm (Accessed 20 January 2011).
[27] Walter A. McDougall, *…Heavens and the Earth*, 56.
[28] William E. Burrows, *The New Ocean*, 180.

space leadership would unite the Soviet populace behind a common cause of national pride, remove the shackles of backwardness still haunting the Soviet psyche, and threaten the west with rockets capable of delivering nuclear payloads. The Soviet Union's technocratic approach to aerospace allowed Khrushchev significant leeway in allocating resources to Korolev's rocket program. This unified effort behind rocketry allowed Soviet scientists to announce intentions to launch a satellite within two years of the 1955 International Geophysical Year conference in Denmark.[29] The space race had officially begun, but few in the United States were paying attention.

Within the United States, post war rocketry efforts were heavily fractured between the military programs of the US Air Force and Army, and the civilian scientific research programs of the Naval Research Laboratory (NRL). Of all the various deign efforts, the US Army's Jupiter program, under the direction of Dr. Braun, was the most advanced due to its projected use as America's first Intercontinental Ballistic Missile (ICBM).[30] Unlike the US Air Forces' Thor missile or the NRL's Vanguard atmospheric sounding rocket, Jupiter possessed the ability to accelerate small payloads to orbital velocity as early a 1955.[31] However, the notion of using a military rocket for space exploration posed a quandary for the administration of President Dwight Eisenhower.

Eisenhower was extremely aware of the hair-trigger dangers of nuclear Armageddon in the early days of the Cold War. As such, he was wary of any effort that hinted at the militarization of space.[32] The Soviet Union could view non-scientific payloads launched from atop a military

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[29] John Hillaby, "Soviet Planning Early Satellite," *New York Times*, 3 August 1955, http://select.nytimes.com/gst/abstract.html?res=F5091FFC385C177B93C1A91783D85F418585F9 (Accessed 15 January 2011).
[30] James Schefter, *The Race*, 15.
[31] James Schefter, *The Race*, 18.
[32] Pat Norris, *Spies in the Sky: Surveillance Satellites in War and Peace* (Chichester:UK, Praxis Publishing, 2008), 9.

Jupiter missile as an act of aggression. Furthermore, the Russians could interpret US satellite over flights as serious violations of sovereignty. Eisenhower was also reluctant to shape the US government as a technocratic state.[33] He viewed the scientific exploration of space as something better left for civilian researchers.

Within the context of Eisenhower's fiscally conservative New Look agenda, military rocket programs served only to establish a credible deterrent threat to Soviet capabilities. As explained by historian Walter McDougall, "It was not imperative that the United States be the first to do this or that, only that it be prepared to deploy missiles in equal or greater numbers at a higher level of guidance, survivability, and reliability."[34] As a result of these policies, the civilian Vanguard program languished in obsolescence, and the military Jupiter rocket was heavily curtailed to serve strategic deterrence purposes only.[35]

This split between military and civil rocketry was deeply rooted in US cultural norms valuing a *laissez-faire* approach to technology development. The utility of either the Soviet technocratic approach or the US hands-off approach to the space race would come to a culmination point in October of 1957.

The Long Shadow of Sputnik

The cover page headline of the *New York Times* on 5 October 1957 captured the gravity of the moment poignantly; "Soviet Fires Earth Satellite Into Space; It Is Circling The Globe at 18,000 MPH; Sphere Tracked In 4 Global Crossings Over US."[36] True to their announced intentions in 1955, Korolev's rocket team launched *Sputnik* (Fellow

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[33] Walter A. McDougall, *…Heavens and the Earth*, 397.
[34] Walter A. McDougall, *…Heavens and the Earth*, 133.
[35] James Schefter, *The Race*, 16.
[36] William J. Jorden, "Soviet Fires Earth Satellite Into Space," *New York Times*, 5 October 1957, http://www.nytimes.com/partners/aol/special/sputnik/sput-01.html (Accessed 15 January 2011).

Traveler) from Baikonur on 4 October 1957.[37] Boosted into orbit by a modified Soviet R-7 ICBM, *Sputnik* orbited the Earth for three months and was visible from the ground with the naked eye.[38] The Soviets deliberately designed its radio transmitter to broadcast a continuous string of beeps in the shortwave frequency band so that amateur radio hobbyist would be able to track its position across the globe.[39] The Soviets followed up one month later with the successful launch of *Sputnik 2*. This satellite, weighing in at 1,120 pounds, was significantly more advanced and carried Earth's first living space traveler; a mongrel dog named *Laika* (Barker).[40] *Laika* survived on orbit long enough to prove that life was sustainable in a weightless environment.[41,42] The Soviets were clearly interested in human space travel.

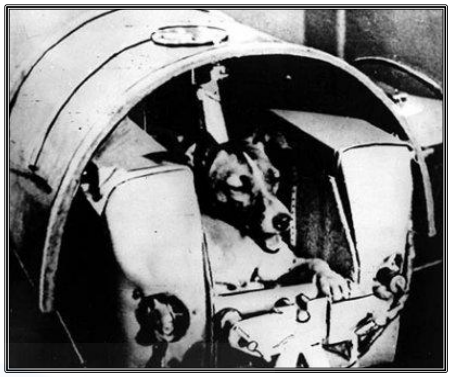

Figure 7: Laika, the World's First Space Traveler

Source: "Dogs in Space," *Space Online Today*, http://www.spacetoday.org/Astronauts/Animals/Dogs.html (Accessed 14 May 2011).

Edwards R. Murrow, veteran CBS reporter, captured the world's stunned reaction to *Sputnik* best when he said, "We failed to recognize that a totalitarian state can establish its priorities, define its objectives,

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[37] Paul Dikson, *Sputnik: The Shock of the Century* (New York: NY, Walker&Company, 2001), 9.
[38] Paul Dikson, *Sputnik: The Shock of the Century,* 17-27.
[39] James Schefter, *The Race*, 16.
[40] James Schefter, *The Race*, 24.
[41] Chernov, V. N., and V. I. Yakovlev, *Scientific research during the flight of an animal in an artificial earth satellite*, Artif. Earth Satell., No. 1, 80-94, 1958.
[42] Differing accounts exist as to how *Laika* died. The Soviets never planned to return *Sputnik* 2 to Earth. Hence, *Laika's* fate was sealed the moment the rocket launched from the pad. However, some accounts state that *Laika* survived for a few hours upon reaching orbit and then died of heat exhaustion due to her "excited" state and a malfunction in the environmental system. Others state that she survived for several days and then died from a "merciful" lethal injection administered remotely from ground control. Either way, the author prefers not to add to the speculation and instead to simply recognize *Laika's* brief, but significant, contribution to human spaceflight.

allocate its money, deny its people automobiles, television sets and all kinds of comforting gadgets in order to achieve a national goal."[43] The US attempted to counter the Soviet successes with a live TV broadcast of the launch of NRL's Vanguard rocket. At liftoff, the Vanguard rocket rose approximately four feet off the launch pad before exploding and collapsing back into a roiling cloud of rocket fuel and debris.[44] Dubbed "Flopnik" or "Kaputnik" by the press, the Vanguard failure only highlighted the extraordinary technical accomplishment of the Soviets and publically embarrassed an already humiliated United States. In desperation, Eisenhower finally authorized the use of the military Jupiter missile for orbital spaceflight. Using the Jupiter rocket, Dr. Braun's team was able to delivered Explorer I, America's first satellite, to orbit on 31 January 1958.[45]

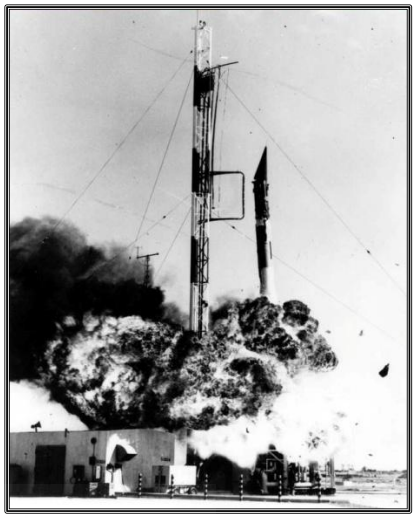

Figure 8: America's Flopnik

Source: *US Navy & NASA*, http://www.accessscience.com/overflow.aspx?searchStr=Rocket&stype=10&p=2 (Accessed 11 May 2011)

Unfortunately, the damage to American honor was extensive. Soviet rocket successes deeply challenged Eisenhower's faith in the viability of a non-technocratic society. Internationally, America's reputation as the most advanced and progressive nation on Earth was tarnished.[46] Domestically, Eisenhower faced non-stop onslaughts from powerful education and science lobbies demanding action.[47] Democratic Presidential nominee John Kennedy excoriated Eisenhower's Republican

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[43] William E. Burrows, *This New Ocean* (New York, NY: Random House, 1999), 190.
[44] William E. Burrows, *This New Ocean* (New York, NY: Random House, 1999), 204.
[45] Paul Dickson, *Sputnik: The Launch of the Space Race.* (Toronto, Canada: MacFarlane Walter & Ross, 2001), 190.
[46] William E. Burrows, *The New Ocean*, 141-148.
[47] William E. Burrows, *The New Ocean*, 141-148.

administration for its slow reaction to Soviet rocketry advances and looming missile gap.[48] Premier Khrushchev, aware of the geopolitical reverberations caused by the *Sputnik* successes, touted the Soviet political system as superior to the West and flaunted the potency of Russia's rockets to deliver a nuclear payload at will.[49] Eisenhower's only silver lining was that *Sputnik's* mission forever settled the legality of satellite flight over sovereign nations. Using *Sputnik* as a precedent, Eisenhower secretly green lighted military efforts to develop and operate spy satellites under the CORONA program.[50]

Shortly after *Sputnik*, the United States passed the Space Act of 1958. This act authorized the formation of the National Aeronautics and Space Administration (NASA) and charged the agency with the purpose of peaceful space exploration.[51] Peaceful or not, NASA's mission was a centerpiece in the global ideological struggle between democracy and communism. As such, the human space programs of both the United States and the Soviet Union accentuated the characteristics of their respective societies and highlighted spaceflight's utility to grand strategy.

Celestial Knights and their Mighty Steeds

Like the heroic aviators and flying machines of the Golden Age of aviation, each nation's space travelers and spacecraft were symbols of their respective cultural values and reflected each nation's view of honor. In America, virtually every astronaut for the Mercury, Gemini, and Apollo programs was a professionally trained test pilot well familiar with the dangers of operating high performance airplanes in

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[48] James Schefter, *The Race*, 46.
[49] William E. Burrows, *The New Ocean*, 194.
[50] Walter A. McDougall, *…Heavens and the Earth*, 134.
[51] National Aeronautics and Space Administration, *Space Act of 1958*, Pub. L. No. 85-568 72 Stat. 426-438, 29 July1958, 16.

experimental situations.[52] Not until the final astronaut selection for the Apollo program did NASA allow a small cadre of civilian candidates from other career fields. Many of the 1960's era astronauts were combat veterans of the Korean War; several had shot down enemy MiG fighter jets. All held engineering, scientific, or mathematical Bachelor degrees with several holding advanced Masters or Doctorate qualifications. Each devoted a significant portion of their official duties to participate in widely celebrated public affairs spectacles on behalf of America. In particular, each of the original Mercury 7 astronauts split a $500,000 contract from *Life* magazine in order to showcase the image of an idyllic American family.[53] Similar contracts were offered to the Gemini and Apollo selection groups, although these later generation agreements were not as generous or lucrative.

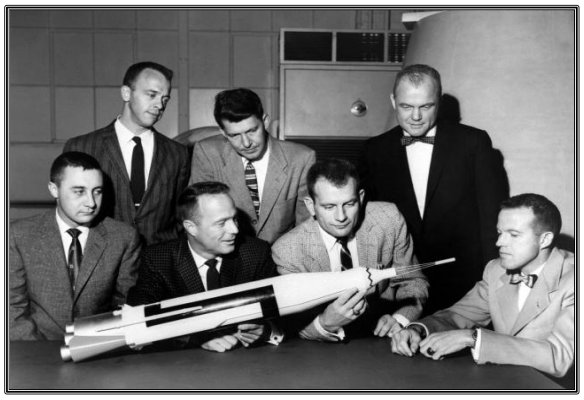

Figure 9: Mercury 7 Astronauts

Source: *NASA Langley*, http://vintagespace.wordpress.com/2010/12/07/designing-the-perfect-astronaut/ (Accessed 22 April 2011).

Because of their test backgrounds and advanced education, astronauts were integral to the design of the Mercury, Gemini, and Apollo spacecraft. Each spacecraft featured redundant flight control systems and avionics similar to contemporary fighter aircraft. Later generations of Gemini and Apollo spacecraft not only featured the ability to shift orientation of the spacecraft, but also the ability to change orbit and use onboard radar to dock with other vehicles.

Hence, the United States selected its astronauts to serve as symbols of self-confidence, courage, and wholesome American family

[52] James Schefter, *The Race*, 52.
[53] James Schefter, *The Race*, 108.

values; concepts of American honor important for both the domestic and international audience. The American cultural values of freedom and openness meant that each astronaut's mission was broadcast real-time to the public. As a result, success or failure during these missions became a subject of intense international drama. Because of these characteristics, America presented, live to the world, the heroic image of free men using their individual talents and abilities to conquer the high ground of space using awe-inspiring and dangerous machines.

In contrast, the Soviets adopted a much different approach to the design of their human spaceflight program. Korolev placed tremendous emphasis on the cosmonauts ability to perform programmed tasks and rely upon automation. Early in the selection process he stipulated, "As has been repeatedly demonstrated in our automated flights and those with animals on board, our technology is such that we do not require, as the American Mercury project does, that our early cosmonauts be highly skilled engineers."[54] As the cosmonauts were essentially medical test subjects, selection criteria heavily favored candidates with unblemished health records and professional athlete-like physical fitness. While strict medical standards were also a characteristic of the US astronaut selection program, the Soviets exalted this quality above all other factors.[55]

Figure 10: Sergei Korolev, two trainers to his left, sits surrounded by the original six cosmonauts

Source: James Oberg, "Space Propaganda," *Wired Magazine*, 12 April 2011, http://www.wired.com/wiredscience/2011/04/soviet-space-propaganda?pid=1181&viewall=true (Accessed 14 April 2011).

[54] Yevgeni Karpov, "Beginnings," in Viktor Mitroshenkov, *Pioneers o] Space* (Moscow: ProgressPublishers, 1989), 18.
[55] James Schefter, *The Race*, 107.

The group of six original cosmonauts selected from the Soviet Air Force, known secretly in the Soviet Union as the Vanguard Six, was politically loyal to the Communist Party and had demonstrated track records of obedience to superiors. They were young and relatively untried compared to their American counterparts. Five out of the six were in there mid-twenties, none were test pilots, and only two possessed college degrees.[56] All of the six came from frontline Soviet Air Force fighter units, but only one flew what was considered at the time as a high performance fighter aircraft (MiG-19).[57] The most experienced pilot in the Vanguard Six had only 900 flight hours.[58] Yuri Gagarin himself possessed only 230 flight hours, roughly equivalent to the flight experience of a brand new fighter pilot in an American fighter squadron.[59] Space historian Asif Siddiqi summed up this difference between the qualifications of astronauts and cosmonauts when he wrote, "there was simply no requirement [among the Soviets] for significant piloting experience or skill at that point. The candidates had to be intelligent, comfortable with high-stress situations, and most of all physically fit."[60]

All cosmonaut personal and professional lives were heavily sequestered from the public. Operational security protocols were so strict that each cosmonaut adopted a covert personal codename to use while flying space missions. Yuri Gagarin's personal codename during his *Vostok 1* mission was Cedar, while Valentina Tereshkova's was

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[56] "At the Request of the Readers:Detachment of Air Force's Cosmonauts" (English title), Auiatsiya *ikosmonautika* no 5 (May 1990): 46-47.
[57] Yaroslav Golovanov, "Koroleu Fakty," Rex Hall, "Soviet Air Force Cosmonauts." in Michael Cassutt. ed., Who's Who in *Space The International Space* Year *Edition* (New York:Macmillan, 1993), 210.
[58] Yaroslav Golovanov, "Koroleu Fakty," Rex Hall, "Soviet Air Force Cosmonauts" in Michael Cassutt. ed., Who's Who in *Space The International Space* Year *Edition* (New York:Macmillan, 1993), 210.
[59] Yaroslav Golovanov, "Soviet Air Force Cosmonauts," 210.
[60] Asif A. Siddiqi, *Challenge to Apollo: The Soviet Union and the Space Race 1945-1974,* NASA SP-2000-4408, 247.

Seagull during *Vostok VI*.[61] As a result, unlike their US counterparts, cosmonauts were lionized by the Soviet government as heroes only *after* a successful flight, never before. For instance, while the identities of Yuri Gagarin, Valentina Tereshkova, and Gherman Titov were state secrets before their missions, all three were foisted as international goodwill ambassadors of communism in the immediate aftermath of their spaceflights.[62]

The *Vostok* and *Voshkod* series of spacecraft were essentially spherical capsules with a small observation window. The cosmonauts sealed inside had almost no ability to control their spacecraft. Rather, spacecraft operations were fully automated or controlled from ground stations. During the *Vostok* and *Voshkod* program, Korolev expressly forbade cosmonaut design inputs, believing that engineers and scientists were better suited for spacecraft design than pilots were.[63] He viewed a cosmonaut's chief duty as performing medical experiments designed to chronicle the human body's reaction to weightlessness.

The only spacecraft controls available to the cosmonaut were a series of switches that manually activated the retrofire engines.[64] These controls were for emergency use only. However, to prevent a cosmonaut from individually using the retrofire engines to alter the planned descent and possibly defect to the West, the switches were protected by a six-digit cipher lock.[65] The first three digits of the combination flew with the cosmonaut in a sealed envelope. Mission control guarded the remaining three digits. As a further indicator of the distrust inherent within the

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[61] "Valentina Tereshkova", *Encyclopedia of World Biography*, http://www.notablebiographies.com/St-Tr/Tereshkova-Valentina.html (Accessed on 10 February 2011).
[62] Michael Sheehan, *The International Politics of Space* (New York: NY, Routledge, 2007), 57.
[63] Yevgeni Karpov, "Beginnings," in Viktor Mitroshenkov, *Pioneers of Space* (Moscow: ProgressPublishers, 1989), 18.
[64] James Schefter, *The Race*, 108.
[65] James Schefter, *The Race*, 108.

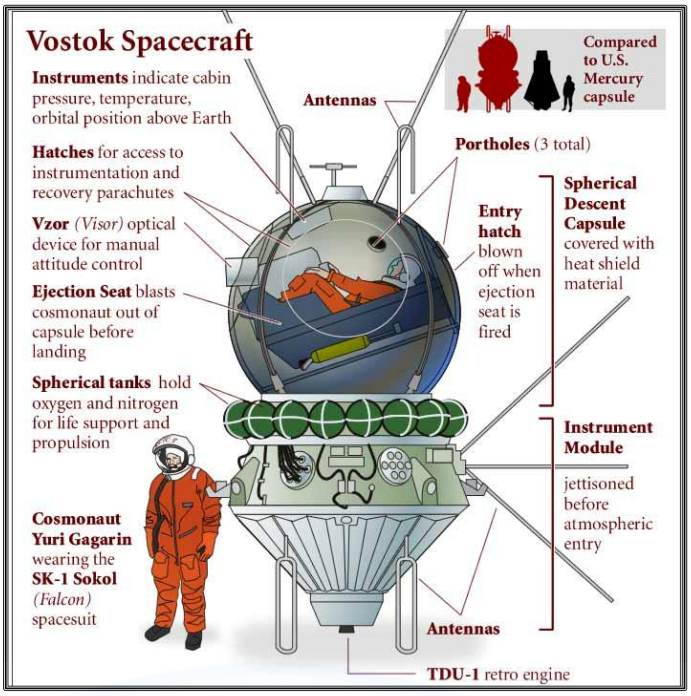

Figure 11: Vostok Capsule Diagram

Source: Asif Siddiqi, James Harford, and Dr. Wayne R. Matson, "Vostok Spacecraft," http://spaceresearchby.webs.com/apps/photos/photo?photoid=76224258 (Accessed 22 April 2011).

realities of Soviet life, each *Vostok* capsule was fitted with a secret compartment of explosives unbeknownst to the cosmonaut. In the event that a *Vostok* capsule was in danger of de-orbiting into enemy territory, mission controls could destroy *Vostok* remotely.[66]

Finally, normal recovery operations dictated that cosmonauts eject from the capsule at 20,000 feet.[67] Although the *Vostok* capsule itself used a recovery parachute, remaining with the capsule during ground impact was potentially fatal. The Soviets hid this secret capsule design for many years, as its discovery would have invalidated many *Fédération Aéronautique Internationale* (International Aeronautical Federation) records won by the Soviet human spaceflight program.[68]

[66] James Schefter, *The Race*, 108.
[67] James Schefter, *The Race*, 136.
[68] James Schefter, *The Race*, 136.

These aspects of the Soviet cosmonaut program were in stark contrast to the American approach. Unlike the United States, the Soviet space program operated behind a dark veil of secrecy. The Soviets banned the live broadcast of any space mission to orchestrate an illusion of infallibility. The Soviet government trumpeted successful missions to the world as glorious proof of communist superiority. Missions that failed to meet objectives were hidden and disavowed. Moreover, Korolev's insistence on minimal cosmonaut control of the spacecraft emphasized Soviet faith in the ascendance of technology over the limitations of humans.[69] As such, the Soviet approach to human spaceflight, as well as domestic and international honor, echoed many of the aspects of compensatory symbolism evident during the Golden Age of flight. Hence, both the American and Soviet human spaceflight programs were designed as reflections of their individual societies and loudspeakers for garnering global honor. As such, they became specially crafted tools of statecraft during the 1960s.

Early Space Age Geopolitics

The Soviets upstaged the United States not only with the launch of *Sputnik*, but also with the subsequent launches of the first person, Yuri Gagarin, first woman, Valentina Tereshkova, the first orbit of two crewed spacecraft simultaneously, and the orbit of three cosmonauts in a single capsule.[70] The Soviets seemed to be on a technological tidal wave of success that hobbled the West at every turn. Khrushchev used Tereshkova's flight in particular to highlight the difference between Soviet and Western society. As stated by Soviet space engineer Yu Zaitsev, "Once more the genuine equality between men and women in the USSR was made evident to the whole world; the courage, intelligence

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[69] Yevgeni Karpov, "Beginnings," in Viktor Mitroshenkov, *Pioneers of Space* (Moscow: ProgressPublishers, 1989), 18.
[70] James Schefter, *The Race*, 181.

and skill of Soviet men and women, liberated from the shameful yoke of capitalistic 'civilization' was made evident."[71] Tereshkova's flight was particularly embarrassing to the United States; a nation featuring an all male astronaut corps and a society wracked in vicious racial violence.

This apparent Soviet supremacy in space gave Khrushchev special leverage in East Germany following the flight of cosmonaut Gherman Titov. Upon the landing of Titov's *Vostok 2* mission, Khrushchev approved the construction of the Berlin wall in Germany.[72] The west, humbled by Soviet technical rocketry advances and fearful of nuclear retaliation, was virtually powerless to address Soviet action.

In the United States, shortly after President Kennedy assumed office, the failed CIA plot to invade Cuba at the Bay of Pigs further tarnished the international honor of America. Not long thereafter, Gagarin's successful flight trumped America's efforts to launch the first human into orbit. Khrushchev's efforts to construct the Berlin wall only served as another source of deep frustration. Acutely embarrassed by a string of political failures early in his presidency, Kennedy decided to use the space program for grand strategic leverage.

By setting the moon as a space program goal, Kennedy sought to change the space race equation. Developing technology to reach the moon would require the Soviets and Sergei Korolev to retool and slow the pace of the Russian space program. This in turn would mitigate the political effects of Soviet space successes. Furthermore, flights to the moon would require tremendous technological innovation and a focused effort from industry. As such, Kennedy could use the space program as a means to marshal a technocratic style, socially supported organization able to counteract the Soviet program. For Kennedy, the moon was a

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[71] Yu I. Zaitsev, *From Sputnik to Space Station* (Yorks, United Kingdom: British Library, 1974), 57.
[72] James Shefter, *The Race*, 149.

deliberately difficult target to achieve and the most visible affirmation of the ideological dynamics of the Cold War.[73] As a pragmatic politician knowledgeable about Soviet compensatory symbolism, he also knew that a moon race was a challenge the Soviets were ill suited to win, but simultaneously unable to willfully cede to the Americans. To their detriment, it was a race the Soviets had to run.

By the conclusion of the Mercury program, the United States had achieved parity with many of the Soviet space accomplishments. During project Gemini, Mercury's successor program, the United States surged well into the lead. Beyond 1965, the substantive space technological build-up approach used by the United States proved superior to the Soviet stunt-flight approach. While cosmonaut Alexei Leonov was the first to perform a spacewalk, the Americans were the first to perfect the technique.[74] While the Soviets were the first to orbit two spacecraft simultaneously, Gemini was the first to successful perform a rendezvous and docking.[75] At a pace of one rocket launch every two months, each Gemini mission improved upon the technological accomplishments of the previous mission. It was a pace of operations that Korolev's capsules and boosters were unable to match. By 1967, even with the tragic launch pad fire of Apollo 1 and the death of three astronauts, the world understood how far the United States had surged ahead of Russia.

In 1964, Sergei Korolev suddenly died from complications during routine surgery.[76] Korolev's death threw the Soviet program into tremendous disarray. Many within the Soviet space program knew the race to the moon was lost as well as any associated political advantage

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[73] William E. Burrows, *The New Ocean*, 323.
[74] Nicholas L. Johnson, *Handbook of Soviet Manned Space Flight: Volume 48*, (San Diego, CA : Univelt Publishing, 1980), 79-82.
[75] Nicholas L. Johnson, *Handbook of Soviet Manned Space Flight: Volume 48*, 45-49.
[76] James Schefter, *The Race*, 231.

gained by attempts to best the Americans. In the late 1960s, the Soviet space program fractured between efforts to build space stations and efforts to continue the appearance of a robust moon program.[77] This bifurcation of resources proved the death knell for the Soviets. Neither program gained sufficient technical or engineering traction. The catastrophic and expensive failures of the Soviet's colossal N1 moon rocket program, the counterpoise to the gargantuan American Saturn V, sealed the Soviet human spaceflight program's fate.[78] The race to the moon was over.

Following an investigation into the Apollo 1 fire, the Americans resumed the moon race with a string of spectacular successes. Apollo 7 proved the human spaceflight viability of the Apollo capsule while Apollo 8 captured the world's attention by the first human circumlunar mission.[79] Apollo 9 was a successful test flight of the Lunar Excursion Module in Earth orbit and Apollo 10 was a dress rehearsal mission for the moon landing.[80] By the time Neil Armstrong and Edwin Aldrin set foot upon the moon's Sea of Tranquility on 20 July 1969, America's global honor and technological prowess in relations to the Soviets were undisputed.[81] The geopolitical impact of attaining these laurels, however, was far more murky than originally intended.

The world of 1969 was dramatically different from the world of 1960. The charismatic energy, vision, and leadership of President

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[77] "Manned Lunar Program," http://www.russianspaceweb.com/spacecraft_manned_lunar.html, Russian Space Web (Accessed 14 April 2011).
[78] James Schefter, *The Race*, 282.
[79] "Apollo," *NASA*, http://www.nasa.gov/mission_pages/apollo/missions/index.html (Accessed 23 April 2011).
[80] "Apollo," *NASA*, http://www.nasa.gov/mission_pages/apollo/missions/index.html (Accessed 23 April 2011).

[81] William E. Burrows, *The New Ocean*, 425-432.

Kennedy were lost to an assassin's bullet in 1963.[82] Kennedy's spacepower nemesis, Premier Khrushchev, was removed from office by Communist Party elites following Khrushchev's dismal performance during the Cuban Missile Crisis. Premier Leonid Brezhnev replaced Khrushchev and directed Russian efforts more towards nuclear militarization efforts rather than headline grabbing space stunts. President Lyndon Johnson's domestic social focus during his Great Society program and President Richard Nixon's increasing involvement in Vietnam meant less focus on the dynamics of the space race. As evidence, NASA's budget as a percentage of gross domestic product shrank from its 1966 high of 4.41% to 2.31% by 1969.[83] Adjusted for inflation, this loss is the year 2010 equivalent of a programmatic budget reduction of nearly $10.7 billion in three years.[84] From the public opinion standpoint, landing men on the moon had tremendous emotional significance, but fell far short of the geopolitical promise of defeating communism through extolling the virtues of freedom and democracy. Civil strife still dominated US domestic concerns, vicious wars still raged in far off lands, and the specter of nuclear doomsday still held the world captive despite the spectacularly successful Apollo program.

Conclusions

This synopsis of human spaceflight to advance the cause of national honor presents several important lessons for a strategist. First,

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[82]Walter A. McDougall, *...Heavens and the Earth*, 396.
[83] "NASA Budget History," *Office of Management and Budget and Augustine Commission Report*, 9 May 2000, http://www.rain.org/~bmuniz/Space/nasa_budget_history_total_budget.pdf (Accessed 11 March 2011).
[84] "NASA Budget History," *Office of Management and Budget and Augustine Commission Report*, 9 May 2000, http://www.rain.org/~bmuniz/Space/nasa_budget_history_total_budget.pdf (Accessed 11 March 2011).

when a state is primarily motivated by Thucydides' concept of honor, its human spaceflight programs will become a portrait reflection of sacred cultural values and a bullhorn to announce societal superiority to the world. From the early era of aviation to the heady days of the space race, the need to garner honor caused ideology to permeate all levels of aerospace development from the iconic status of aviators and space travelers, to the types of programs pursued, and even down to the minute technical details of aircraft and spacecraft engineering design. Honor will cause a heavy emphasis on the achievement of technological superlatives as a demonstration of state superiority. Building the largest or fastest aircraft, being the first to fly a human in space, or being the first to land on the moon are all prime examples of the thirst for first motivated by the quest for honor. However, the saga of aviation and human spaceflight in Russia offers a cautionary tale for when this quest becomes distorted into compensatory symbolism at the expense of substantive technological achievement.

Second, any gains from the pursuit of honor are extremely subjective and entirely dependent upon the overarching international relations and domestic context. Whether it was the Soviet or American approaches to culture and technology in society, pure reliance on honor as a motivator for human spaceflight is a dangerous proposition. For example, despite impressive accomplishments, gains in state honor from human spaceflight in the 1960s were not able to save America's space program from staggering financial cuts and massive losses in political clout during the 1970s. Furthermore, despite the hopes of state leaders, ideological triumph in space had little correlation to ideological supremacy on Earth. Hence, while honor is a tremendously powerful motivator to cause states to embark on amazing human spaceflight programs as a tool of grand strategy, it must not be the only motivator. In this light, honor is a necessary, but not sufficient, condition for a

robust human spaceflight program. This insight is essential for a spacepower strategist as it helps to set realistic expectations and define human spaceflight's role in state strategy with respect to honor goals.

Geopolitical dynamics during the 1960s and 1970s offered another powerful grand strategic role for human spaceflight. Rather than a tool to wrest global honor, the Cold War entered an era increasingly marked by the use of human spaceflight as an instrument for both global military defense and peace under the spirit of Détente.

Chapter 2

DOVE OF PEACE AND HOUND OF WAR

Fear's impact on human spaceflight: 1950-1990

Within the next 10 or 15 years, the earth will have a new companion in the skies, a man-made satellite that could be either the greatest force for peace ever devised, or one of the most terrible weapons of war -- depending on who makes and controls it.

Dr. Werner von Braun, *Collier Magazine*, 1952

In 1952, Dr. Werner Von Braun wrote a series of articles for *Collier* magazine detailing a futuristic version of spaceflight. In one article entitled *Crossing the last Frontier*, Dr. Braun described his concept of an orbiting military battle station.[1] Nuclear armed, serviced by futuristic looking spaceplanes, and occupied by a crew of up to 50 astronauts, Von Braun's fanciful but dark vision of space captivated the attention of the world to the military uses of human spaceflight technology.[2] By the mid 1960's, this concept began to cross the realm from fantasy to reality. By the close of the early space race, both the United States and the Soviet Union turned more and more of their attention from the notion of national honor flights to the notion of employing human spaceflight as a day-to-day practical tool for building peace or waging war. The Thucydides notion of fear became a major driving factor shaping human spaceflight. In this regard, human spaceflight technology filled a niche as a dove of peace and a hound of war. One of the primary technical means with which to fulfill space

[1]Roger D. Lanius, *Space Stations: Base Camps to the Stars*, (Washington, DC: Smithsonian, 2003), 27-35.
[2] Roger D. Lanius, *Space Stations: Base Camps to the Stars*, 27-35.

security originated at Austria's University of Vienna at the dawn of World War II.[3]

Jousting Spaceplanes of the High Frontier

In the mid-1930s, rocketry expert Dr. Eugene Sanger and his mathematician wife Dr. Irene Brendt began studies into an exo-atmospheric, hypersonic, crewed vehicle capable of reaching and bombing targets on the other side of the globe.[4] The craft was a futuristic wonder weapon; featuring a behemoth takeoff weight of 110 tons and a special two mile long horizontal rail launch system that would accelerate the vehicle to takeoff speeds in excess of 1,100 mph.[5] The *Luftwaffe* studied the concept under their World War II *Amerika* Bomber program, but ultimately decided it posed too many technical challenges given Germany's limited resources and wartime realties.[6] However, plans for the Sanger-Brendt Antipodal Bomber, as the concept came to be known post World War II, became an engineering means with which to satisfy deep-seated security fears within both America and the Soviet Union.[7]

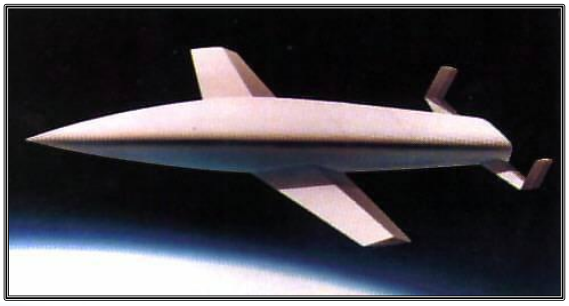

Figure 12: Sanger-Brendt Antipodal Bomber Concept

Source: MBB, "Saenger," http://www.astronautix.com/lvs/saenger.htm, (Accessed 25 April 2011)

Within the United States, the spotlight on the prestige garnering Mercury, Gemini, and Apollo space programs masked an ever-growing

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[3] Robert Godwin, *Dyna-Soar: Hypersonic Strategic Weapon System* (Ontario: Canada, Collector's Guide Publishing, 2003), 7.
[4] Bart Hendrickx and Bert Vis, *Energiya-Buran* (Chichester: UK, Praxis Publishing, 2007), 13.
[5] *History of the X-20A Dyna-Soar. Volume 1* (USAF Systems Command, Aeronautical Systems Division. Technical Report ASD-TR, 1983) 3.
[6] Robert Godwin, *Dyna-Soar: Hypersonic Strategic Weapon System*, 7.
[7] Bart Henrickx and Bert Vis, *Energiya-Buran*, 13.

Department of Defense push in the late 1950s and 1960s to exploit human spaceflight for strategic military advantage. In this era, the specter of nuclear doomsday held the world hostage to the palpable fear of instant global annihilation. The power to hold these fears at bay, through an impressive nuclear deterrent capability, became the showcase military mission of the early Cold War.[8] Hence, the embryonic United States Air Force, ever mindful of the need to justify its existence within the Department of Defense, began to envision human spaceflight as a tantalizing way to expand global reach to the high frontier. Senior Air Force leaders foretold of an era in which the military person's role in spaceflight would be indispensible to national security objectives. General Bernard Shriver, commander of Air Force Systems Command, summarized this sentiment best in a 1961 paper he authored entitled, *Manned Operational Capability in Space*.

> More emphasis on manned spacecraft is required. We must develop the ability to use space on a routine, day-to-day basis. In order to develop this ability we must begin by developing the ability to place large payloads in space, the ability to navigate and maneuver spacecraft, the ability to go into space and return to earth at times and places chosen to support a selected mission, the ability to rendezvous in space and accomplish refueling or cargo transfer; in short, to transport, use, and support man in space.[9]

From this perspective, advances in technology blurred the distinctions between the air and space domain such that orbital flight would be the natural extension of atmospheric flight. In similar fashion to the ascendancy of jet airplanes over propeller driven aircraft, spacecraft would eventually assume the same missions as their conventional atmospheric counterparts, albeit at much higher speeds and altitudes. Inherent in this desire for military human spaceflight

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[8] Jeffrey G. Barlow, *Revolt of the Admirals* (Washington, DC: Ross and Perry, 2001), 293.
[9] Bernard Shriver, *Manned Operational Capability in Space*, November 1961.

was steadfast faith, in the face of tremendous advances in automation and ballistic missile technology, of human's utility to aerospace combat. General Curtis LeMay, Vice Chief of Staff of the Air Force, championed this view when he stated, "The most reliable guidance system we have is man. Should a more reliable and lighter weight system be developed, it will still lack judgment. And judgment is essential in war."[10] Within this context was the genesis of a state-of-the-art crewed spaceplane designed to best the Soviets in a strategic war.

In September of 1962, amidst a lavish Las Vegas convention center gala, the United States Air Force officially unveiled Dyna-Soar; a sleek, delta shaped, black, hypersonic, gliding spaceplane designed to place the Soviet Union on notice concerning US spacepower capabilities.[11] Sharing the stage that day with the futuristic spaceplane was General Shriver along with six specially recruited initial cadre test pilots; five were from the Air Force and one was a retired Navy test pilot currently flying for NASA.[12] Using the legacy work of the vaunted X-15 program, Dyna-Soar was envisioned as a single seat, multi-role, combat spaceplane that would skip along the outer reaches of Earth's atmosphere while performing its

Figure 13: Dyna-Soar Spaceplane

Source: Steve Weintz, "Dyna-Soar: The Air Force's Manned Spaceplane of 1960," *USAF*, http://www.warisboring.com/2010/07/10/dyna-soar-the-air-forces-manned-spaceplane-of-1960/ , 10 October 2010 (Accessed 28 April 2011).

[10] Curtis E. LeMay, "Future of Manned Bombers," *Ordnance Magazine*, September-October, 1958, 205.
[11] Apogee Books, *Las Vegas Rollout*, Dyna-Soar Movies, 11 min., 2003, DVD.

[12] Apogee Books, *Las Vegas Rollout*, Dyna-Soar Movies, 10 min., 2003, DVD.

reconnaissance, anti-satellite, or orbital bombardment mission.[13] At mission completion, Dyna-Soar would then glide to a conventional runway landing at a friendly airbase where it would be serviced in preparation for another mission.[14] Rather than being air launched like its X-15 cousin, Dyna-Soar would rocket to operational speeds and altitudes at the tip of a heavily modified Titan booster. Plans for the program called for three distinct development stages.

Dyna-Soar I was designed as a conceptual research vehicle expected to achieve speeds of 12,000 mph in a ballistic trajectory reaching an apogee of up to 350,000 feet.[15] Dyna-Soar II would be the first militarily operational platform, with a range over 5,000 nautical miles at altitudes of up to 170,000 feet and speeds similar to Dyna-Soar I.[16] Dyna-Soar III, the final version of the spaceplane, would carry a thermonuclear weapon and achieve orbital velocities and global ranges at altitudes up to 300,000 feet[17]. By skimming the Earth's atmosphere at similar speeds to an Intercontinental Ballistic Missile (ICBM), but at much lower altitudes, Dyna-Soar proponents touted a reduction in the Soviet's window of early warning from 15

Figure 14: Capt. Ed Dwight, One of the Original USAF Test Pilots Recruited for the Dyna-Soar Program

Source: UPI , "For the Sheer Love of It," *Aviation News*, http://www.aviation-news.co.uk/archive/Mach%2025.html (Accessed 11 April 2011).

[13] Apogee Books, *This is Dyna-Soar*, Dyna-Soar Movies, 13 min., 2003, DVD.
[14] Apogee Books, *This is Dyna-Soar*, Dyna-Soar Movies, 13 min., 2003, DVD.[14]
[15] Robert Godwin, *Dyna-Soar: Hypersonic Strategic Weapon System*, 42.
[16] Robert Godwin, *Dyna-Soar: Hypersonic Strategic Weapon System*, 44.
[17] Robert Godwin, *Dyna-Soar: Hypersonic Strategic Weapon System*, 45.

minutes to 2 minutes.[18] Yet, even these blistering speeds were not enough to escape the gravity well of US political and economic constraints in the 1960s.

Dyna-Soar's extinction began in early 1962. Early in the program, Congress signified their earnestness for the Dyna-Soar project by voting to fund the program with $158.8 million dollars, fully $85.8 million dollars more than the original request from President Kennedy.[19] However, Secretary of Defense Robert McNamara perceived Dyna-Soar as too expensive in light of the moon race against the Soviets. Several months prior to the roll out ceremony, McNamara signaled his desire to shift Dyna-Soar from an operational spaceplane to a research vehicle like its X-15 predecessor.[20] McNamara capped this decision by mandating a name change from Dyna-Soar to X-20. Development work on the spaceplane continued throughout 1963, however lack of a clear space military strategy and costs spiraling beyond $1 billion dollars doomed the program. In December of 1963, McNamara labeled the X-20 project a "billion dollar turkey" and summarily canceled the program.[21]

Nonetheless, the spaceplane project demonstrated America's willingness to expand the notion of airpower to the new realm of space. In a technological age bounded by nuclear Armageddon nightmares, the high ground of space and the role of military astronauts in strategic warfare was a tantalizing subject. This appealing notion was not missed by the Soviets, who clandestinely pursued their own versions of the Sanger-Brendt spaceplane in the hopes of achieving military advantage.

Much like in the United States, Soviet prestige spaceflights performed under the *Vostok* and *Voshkod* programs greatly

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[18] *Dyna-Soar General Management Proposal/System, 464L* (Seattle: Boeing Airplane Company, 1958). M-29111-7-S, 2-2603.
[19] William E. Burrows, *This New Ocean* (New York: NY, Random House, 1999), 254.
[20] William E. Burrows, *This New Ocean*, 254.
[21] William E. Burrows, *This New Ocean*, 254.

overshadowed alternative spaceplane efforts aimed at addressing state fear. Not until the 1980s, under Premier Mikhail Gorbachev's *Glastnost* (Openness) initiatives, were Soviet records declassified sufficiently to reveal the existence of no less than five design bureau efforts to construct a piloted military spaceplane in the 1950s and 1960s.[22]

Within the *Korolyov* design bureau, designer Pavel Tsybin produced plans for the *PKA* (Gliding Space Apparatus).[23] The *PKA* was a single seat spaceplane designed to fit atop an R-7 booster, achieve orbital altitudes of 186 miles, and perform military missions lasting up to 27 hours.[24] Rival design bureau OKB-23, under the direction of Vladimir Myasishchev, worked on a series of reusable intercontinental rocket planes that would perform strategic reconnaissance using advanced optical, radar, and infrared sensors.[25] In the OKB-156 design bureau, famed Soviet aircraft designer Andrey Tupolev advanced proposals for his *Zvezda* (Star) spaceplane; a 20 ton canard and delta wing shaped vehicle designed for reconnaissance, bombing, and anti-satellite missions.[26] Artyom Mikoyan's OKB-155 design bureau, renowned for its legendary series of Mikoyan-Gurevich or *MiG* fighter aircraft, investigated an ambitious 115 ton, piggy-back spaceplane and hypersonic launching aircraft combination known together as *Spiral*.[27] Mikoyan's work on the *Spiral* project would eventually prove of great merit to the development of the *Buran* (Snowstorm) Russian Space Shuttle nearly three decades later. However, the most audacious counter proposal to the American Dyna-Soar spaceplane originated from Vladimir Chelomey, Sergie Korolev's nemesis rocket design rival.

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[22] Bart Hendrickx and Bert Vis, *Energiya-Buran: The Soviet Space Shuttle* (Chichester, UK: Praxis, 2007), 17.
[23] Bart Hendrickx and Bert Vis, *Energiya-Buran*, 20.
[24] Bart Hendrickx and Bert Vis, *Energiya-Buran*, 20.
[25] Bart Hendrickx and Bert Vis, *Energiya-Buran*, 22-25.
[26] Bart Hendrickx and Bert Vis, *Energiya-Buran*, 26-28.
[27] Bart Hendrickx and Bert Vis, *Energiya-Buran*, 32.

Chelomey's *Raketoplan* (Rocket Glider) was to serve as a reusable intercontinental space bomber. The detailed proposal for *Raketoplan* involved a spaceplane that would launch atop a conventional booster and then use high performance turbojets to maneuver in suborbital flight.[28] Studies indicated that variants of *Raketoplan* would have ranges between 4,900 miles and 24,800 miles.[29] Launched south into a Polar orbit from any latitudes within the Soviet Union, the longer range versions of *Raketoplan* could overfly Antarctica to evade American early warning nets and attack targets, such as Washington DC, from the southern hemisphere.[30] *Raketoplan* received official Politburo support for development on 23 June 1960.[31] The same Politburo decree also consolidated all spaceplane research efforts from the other design bureaus under the authority of Chelomey's OKB-52 organization.[32] Design work continued on the project well into 1964, culminating in the production and sub-orbital flight of two sub-scale test vehicles.[33]

Figure 15: Raketoplan Concept

Source: Dr.Vadim P. Lukashevich, "Raketoplan," http://www.astronautix.com/craft/rakoplan.htm , Accessed 21 April 2011).

However, political and economic realities doomed *Raketoplan* in much the same way as the American Dyna-Soar project. Chelomey lost

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[28] Asif A. Siddiqi, *Challenge to Apollo: The Soviet Union and the Space Race 1945-1974,* NASA SP-2000-4408, 231.
[29] Asif Siddiqi, *Challenge to Apollo*, 231.
[30] Asif Siddiqi, *Challenge to Apollo*, 231.
[31] Bart Hendrickx and Bert Vis, *Energiya-Buran*, 28.
[32] "Raketoplan", *Russian Space Web*, http://www.russianspaceweb.com/raketoplan.html (Accessed 26 February 2011).
[33] [33] "Raketoplan", *Russian Space Web*, http://www.russianspaceweb.com/raketoplan.html (Accessed 26 February 2011).

tremendous political support when his prime benefactor, Premier Khrushchev, was forcefully removed from power by Politburo elites. Khrushchev's replacement, Premier Leonid Brezhnev, preferred the technical expediency and cost savings of ICBMs and reconnaissance satellites in his quest to expand Soviet strategic power in the disastrous wake of the Cuban Missile crisis. In light of Dyna-Soar's cancellation, Soviet political leadership viewed pursuit of the *Raketoplan* as wasteful.

Ultimately, spaceplane projects in both nations failed in the 1960s primarily due to their limited mission focus, expense, and long development times. Within the context of the Cold War, the military benefits of operationally responsive hypersonic reconnaissance, orbital nuclear bombardment, and enemy satellite destruction could only be realized in the event of an actual nuclear war. Considering the extreme costs associated with developing, producing, and operating vehicles such as Dyna-Soar or *Raketoplan*, ICBMs and satellites were a more attractive alternative to address the possibility of global nuclear war. However, as plans for a spaceplane waned in the mid 1960s, military planners in both nations sought alternative human spacepower technologies designed to more effectively address fear during both peace and wartime.

Orbiting Battle Stations

On the day following Dyna-Soar's cancellation, Secretary McNamara approved an alternative USAF project designed to exploit the advantages of military airmen in orbit.[34] In McNamara's view, independent defense studies in the early 1960s indicated that a military space station, cannibalizing much of the existing technology and experience developed for NASA's Gemini program, could effectively accomplish much of Dyna-Soar's original mission at a significantly

[34] William E Burrows, *This New Ocean*, 254.

reduced cost and quicker development schedule.[35] The resulting project, known as the Manned Orbiting Laboratory (MOL), emerged amidst furious turf and budgetary battle between NASA and the Department of Defense over the proper role of military and civilian personnel in space.[36] In an effort to resolve this debate, MOL's primary goal was loosely defined by the Defense Department as, "to learn more about what man is able to do in space and how that ability can be used for military purposes."[37] More specifically, the primary missions of MOL included general reconnaissance, reconnaissance of given spots on request, post-strike reconnaissance, continuous surveillance, and ocean reconnaissance.[38] Assuming the success of these primary roles, additional mission functions would expand to include bombardment, inspection of unknown space vehicles, command and control, and operational support to terrestrial and space military forces.[39]

Mission design requirements for MOL stipulated a station size roughly equivalent to a small house trailer, a design orbit of 350 miles, and the ability to support a crew of two USAF officers in a shirt-sleeve style environment for missions lasting up to 45 days.[40] Crews would transfer from Earth to the MOL in a USAF version of the Gemini capsule known as Gemini-B; a spacecraft

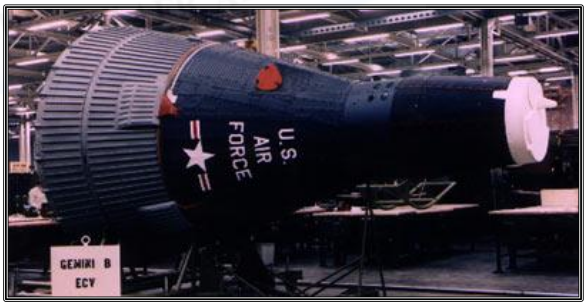

Figure 16: USAF Gemini-B Capsule for Department of Defense Missions to MOL

Source: USAF, "Gemini-B,", http://space.skyrocket.de/doc_sdat/gemini-b.htm , (Accessed 2 May 2011).

[35] Walter A. McDougall, *...Heavens and the Earth* (Baltimore, MD: John Hopkins, 1985), 340.
[36] Philip Baker, *The Story of Manned Space Stations* (Chichester: UK, Praxis, 2007), 10.
[37] William E. Burrows, *This New Ocean*, 255.
[38] William E. Burrows, *This New Ocean*, 256.
[39] William E. Burrows, *This New Ocean*, 256.
[40] William E. Burrows, *The New Ocean*, 255.

that differed most notably from its civilian counterpart by the addition of circular hatch cut through the base of the heat shield to allow access between the space station and the capsule.[41] Stacked together, the Gemini-B and MOL would rocket to orbits as high as polar inclination atop a single Titan IIIC booster launched from Vandenberg AFB.[42] Once on orbit, MOL would serve as a highly flexible platform uniquely adapted to compete with the growing constellation of unmanned satellites. Air Force deputy chief of staff for research and development, Lieutenant General James Ferguson, encapsulated the USAF's primary argument for the program at a congressional hearing.

> Man has certain qualitative capabilities which machines cannot duplicate. He is unique in his ability to make on-the-spot judgments. He can discriminate and select from alternatives which have not been anticipated. He is adaptable to rapidly changing situations. Thus, by including man in the military space systems, we significantly increase the flexibility of the systems, as well as increase the probability of mission success.[43]

Development work on MOL commenced followed President Lyndon Johnson's 25 August 1965 program approval. Efforts included the construction of the Space Launch Complex 6 at Vandenberg Air Force Base, recruitment of 14 military test pilots, and the uninhabited test launch of a Gemini-B and surrogate MOL station aboard a Titan booster.[44] Yet, the extraordinary price tag of the moon missions and increasing sophistication of uninhabited satellites doomed MOL in much the same way as its spaceplane predecessors. By April of 1969, significant schedule delays and budget cuts slipped the first flight of

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[41] "Gemini Spacecraft," *National Museum of the Air Force*, http://www.nationalmuseum.af.mil/factsheets/factsheet.asp?id=551 (Accessed 10 March 2011).
[42] Philip Baker, *The Story of Manned Space Stations*, 10.
[43]William E. Burrows, *This New Ocean,* 255.
[44] Philip Baker, *The Story of Manned Space Stations*, 10-11.

MOL by over several years to 1972.[45] Later in 1969, with program costs soaring beyond $1.3 billion, President Richard Nixon finally canceled MOL.[46] Regardless of its cancellation, however, the impact of MOL created deep reverberations within the Russian defense establishment.

Figure 17: Gemini-B and MOL Surrogate atop Titan III on Test Launch

Source: *NASA*, http://www.nasa.gov/centers/kennedy/about/history/molsuits.html (Accessed 27 April 2011).

The Soviets, ever vigilant to American military spaceflight developments, proposed a series of military space stations as a counter to MOL. However, unlike their American counterparts, the Soviets actually built and flew operational versions of their designs. The primary strategic reason for this difference between the progress of the American and Soviet space programs originated from the Soviet's shift to long duration space station style missions in the mid 1960s upon realizing the moon was lost to the Americans. With the untimely death of Korolev and Chelomey 's resurgence and consolidation of power within the Soviet space program, Soviet scientific and military space goals were in harmony. This harmony, at significant contrast to the dissonance between US civil and military establishments in the late 1960s, resulted in the greater efficiency of bringing concepts to fruition.

In keeping with the themes of secrecy endemic within the Soviet space program, these military space stations were hidden under the civil scientific *Salyut (*Salute) program.[47] *Salyut* 2, 3, and 5 were in reality military space stations, differing from their civilian counterparts by the

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[45] William E. Burrows, *This New Ocean*, 256.
[46] Philip Baker, *The Story of Manned Space Stations*, 14.
[47] Nicholas L. Johnson, *Handbook of Soviet Manned Space Flight*, (San Diego, CA: Univelt, 1980) 213-217.

addition of advanced surveillance gear, the use of frequencies reserved for Soviet military telemetry, lower orbits to improve optical surveillance resolution, and a higher degree of automation.[48] Stations in this configuration flew under the clandestine codename of *Almaz* (Diamond).[49] *Salyut* 3, in particular, was uniquely equipped with a 23mm cannon designed to destroy enemy satellites or prevent hostile boardings by American spacecraft.[50] Rather than using a complex gun turret, the weapon was instead bolted to one end of *Almaz* and bore-sighted along the long axis of the station. Hence, to aim the gun, cosmonauts would need to reorient the entire station using the reaction control system. Soviet space archives record that this weapon was fired only once while on orbit. Ground controllers remotely test fired *Salyut 3's* cannon prior to de-orbiting the station on 24 January of 1975.[51] Although the results of this test are not public record, the Soviet's never again fielded a spacecraft equipped with a cannon.

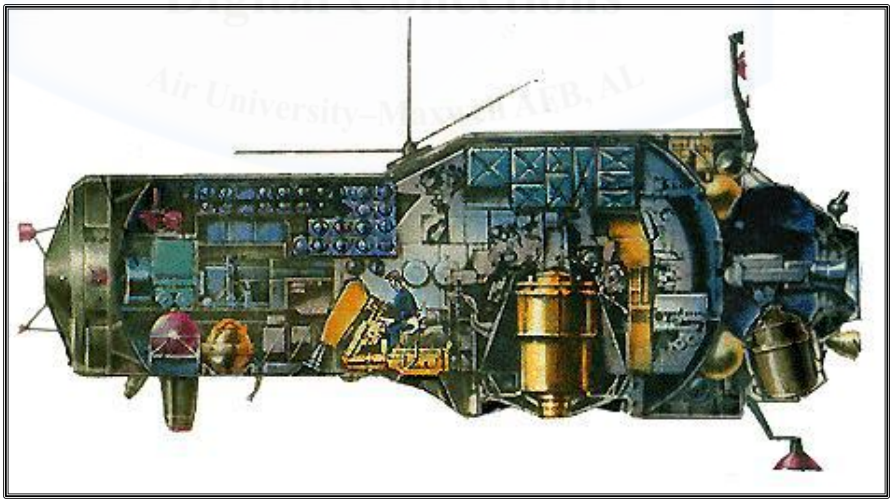

Figure 18: Military *Almaz* Station Cutaway with Crewmember using the Surveillance Camera

Source: VideoKosmos, "Almaz," http://www.astronautix.com/project/almaz.htm, (Accessed 12 April 2011)

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[48] Philip Baker, *Manned Space Stations*, 46.
[49] David M. Harland, *The Story of Space Station MIR*, (Chichester, UK: Praxis Publishing, 2005), 9.
[50] Philip Baker, *Manned Space Stations*, 49.
[51] Philip Baker, *Manned Space Stations*, 51.

Despite tremendous Soviet investment in the *Almaz* program, the legacy of these military stations remains dubious. *Salyut* 2 (*Almaz* 1), launched in 1973, suffered a catastrophic fire and explosion 13 days after achieving orbit.[52] After 55 days of derelict spaceflight, its orbit decayed into Earth's atmosphere after never having received a crew.[53] The only crew to occupy the follow on station, *Salyut 3* (*Almaz 2*), spent 15 days on board and successfully activated the reconnaissance gear to photograph several test targets arrayed in the vicinity of Baikonur.[54] The second planned crew of *Salyut 3*, however, returned to Earth only two days after launch when faulty rendezvous equipment prevented station docking.[55] Delays in solving the rendezvous equipment failure caused no further expeditions to *Salyut 3*. After seven months of spaceflight, spending 93% of its life unoccupied, *Salyut 3* de-orbited over the Pacific Ocean.[56] *Salyut* 5, launched in 1975, was successfully used by the crew of *Soyuz 21* to monitor a Soviet military exercise taking place in Siberia.[57] However, the crew abandoned the station early due to fears over air contaminants in the space station's cabin and reported crew interaction difficulties. Two more expeditions were launched to *Salyut 5*; one was unable to dock and the other only used *Salyut 5* as a test bed to evaluate station atmosphere purging techniques.[58] There would be no further mission to *Salyut 5* before it was de-orbited on 8 August 1977.[59] *Salyut 5's* fiery re-entry trail across the sky became a Viking funeral that marked the last purely military space station of any nation.

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[52] Philip Baker, *Manned Space Stations*, 51.
[53] Nicholas L. Johnson, *Handbook of Soviet Manned Space Flight,* 215.
[54] Philip Baker, *Manned Space Stations*, 51.
[55] Philip Baker, *Manned Space Stations*, 51.
[56] Philip Baker, *Manned Space Stations*, 51.
[57] Philip Baker, *Manned Space Stations*, 58.
[58] Philip Baker, *Manned Space Stations*, 59.
[59] Philip Baker, *Manned Space Stations*, 60.

The saga of the orbital spaceplanes and battle stations reveals an important phenomena concerning military human spaceflight. Intense schedule, cost, and technical feasibility pressures doomed the ambitious Dyna-Soar, MOL, *Almaz*, and *Raketoplan* programs nearly from the cradle. Only one of the four military programs, *Almaz*, made it from concept to operational utility. However even this program was quickly abandoned due to limited operational utility in the face of uninhabited systems. Advances in ICBMs, satellite surveillance, and global communications technology obviated the need for humans to perform these types of missions from orbit. Both nations followed their own tortuous path to arrive at the same conclusion; uninhabited spaceflight for this class of mission may be expensive, but has significantly more economic utility, pound for pound, than sending a human to perform the same task given the current technocratic paradigm.

Yet, not all military space missions of this era focused on human spaceflight as a means to win global war. In the middle of the 1970s, a joint mission between the United States and the Soviet Union highlighted another potential purpose for human spaceflight; that of waging peace to reduce state fear.

The Handshake seen around the World

Geopolitics of the 1970s were scarred by several important events. In a move to bolster Soviet security and regain power around the world, Premier Brezhnev instituted a massive nuclear weapons development program to make up for the missile gap.[60] Brezhnev's program caused the Soviet Union to achieve parity and then exceeded the nuclear capabilities of the United States in terms of raw numbers.[61] However, this massive military buildup was proving to be financially costly for the

[60] Lawrence Freedman, *The Evolution of Nuclear Strategy* (New York, NY: Palgrave, 2003), 300.
[61] Lawrence Freedman, *The Evolution of Nuclear Strategy*, 329.

Soviet Union. In addition, the Soviets were fearful of a deepening split within the communist world because of warming relations between Beijing and Washington DC following President Richard Nixon's famous visit to China in 1972.[62] In the United States, Defense Secretary McNamara realized that nuclear stockpiles of both nations had risen to such absurdity that Mutually Assured Destruction (MAD) would result from any nuclear conflict.[63] Compounding these fears was a deepening American financial crisis and tumultuous domestic strife over US military involvement in the Vietnam War.

Worldwide, an overriding milieu of wartime exhaustion, nuclear fear, and uncertainty cast a pall over international relations. As a result, conditions were ripe for both the United States and the Soviet Union to seek a thaw in the Cold War. Ultimately, this geostrategic initiative to relax tensions culminated in the historic Strategic Arms Limitations Treaty (SALT) negotiations and agreements.[64] Given the tremendous symbolic significance attached to human spaceflight in the early space race, Soviet and American leaders naturally looked to the space program as a means to foster Détente. Within the United States, the means to wage peace via space technology was born in the ashes of the Apollo moon program.

In the aftermath of the Apollo moon landings, NASA struggled to find a new direction for the space program. Waning funding and public attention no longer supported outsized government spending for voyages to the moon. NASA canceled the Apollo 18 through 20 lunar missions and converted the hardware to support the Apollo Applications Program (AAP); a project created in 1965 to provide a post Apollo strategy for

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[62] Stephen R. Randolph, *Powerful and Brutal Weapons* (Cambridge, MA: Harvard, 2007), 25.
[63] Lawrence Freedman, *The Evolution of Nuclear Strategy,* 234-236.
[64] Lawrence Freedman, *The Evolution of Nuclear Strategy,* 338.

America's civil space program[65]. By the early 1970s, grandiose AAP visions of extended missions to the moon were drastically curtailed to match political and economic realities. Nonetheless, AAP still managed to contribute greatly to America's scientific understanding of astronomy and long duration spaceflight by producing Skylab. It also contributed to addressing American nuclear Armageddon fears by providing the equipment and expertise necessary to execute the Apollo-*Soyuz* Test Project.

In the spirit of Détente, President Nixon and Soviet Premier Aleksei Kosygin signed a multi-year agreement on 24 May 1972 to fly a joint space mission in 1975 in hopes of fostering the peaceful use and exploration of space.[66] The agreement resulted in numerous scientific and cultural exchanges between members of both the American and Soviet space program. Considering the remarkable secrecy of the Soviet space program and institutionalized distrust between the two nations, the open sharing of sufficient technical information to allow the successful launch, rendezvous, and docking of two completely different spacecraft was nothing short of remarkable.

Soyuz 19, commanded by Soviet Colonel Alexei Leonov, the world's first spacewalker, launch from Baikonur on 15 July 1975.[67] Seven and a half hours later, the Apollo crew, commanded by Air Force Colonel Tom Stafford blasted off from Kennedy Space Center.[68] Two days later, the two capsules joined in orbit. Before a worldwide television audience of millions, Colonel Stafford and Colonel Leonov opened the hatchway connecting the two capsules and exchanged a hearty handshake. The handshake, the culmination of over three years

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[65] Roger D. Launius, *Space Stations: Base camps to the Stars*, 69.
[66] William E. Burrows, *This New Ocean*, 447.
[67] Philip Baker, *The Story of Manned Space Stations*, 56.
[68] William E. Burrows, *This New Ocean*, 448.

of close cooperation between the Soviet Union and the United States, was the penultimate symbol of Détente.

Figure 19: Colonels Stafford and Leonov Pose with a Commemorative ASTP Plaque

Source: NASA History Office, "The Apollo Soyuz Test Project Image Gallery," *NASA*, http://history.nasa.gov/astp/kipp.html (Accessed 24 April 2011)

However, following the historic Apollo-*Soyuz* mission, the thaw of Détente quickly faded, replaced instead by a return to hardening Cold War stances. By the early 1980, the Soviets had invaded Afghanistan, President Jimmy Carter boycotted the Moscow Olympics in protest, and the US backed Shah of Iran was replaced by the Ayatollah Khomeini in the Iranian Revolution.[69] The United States increased defense spending under the administration of President Ronald Reagan and the Soviet Union's political leadership was thrown into turmoil following the death of Premier Brezhnev.[70,71] These developments highlighted another important lesson for human spaceflight in addressing state fear; noble achievements in space for

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[69] "Iranian Revolution", *Nova Online*, http://novaonline.nvcc.edu/eli/evans/his135/Events/Iran79.htm (Accessed 18 February 2011),
James Phillips, "The Soviet Invasion of Afghanistan," *The Heritage Foundation*, http://www.heritage.org/research/reports/1980/01/the-soviet-invasion-of-afghanistan (Accessed 10 March 2011),
Pierre Tristan, "The 1980 Olympics Boycott over the Soviet Invasion of Afghanistan", *Middle East Issues*, http://middleeast.about.com/od/afghanistan/a/me080803.htm (Accessed 11 March 2011).

[70] "1982: Brezhnev rumours sweep Moscow," *BBC*, http://news.bbc.co.uk/onthisday/hi/dates/stories/november/10/newsid_2516000/2516417.stm, (Accessed 20 April 2011).

[71] "Ronald Reagan's Military Buildup," *US History*, http://www.u-s-history.com/pages/h1957.html, (Accessed 30 April 2011).

peace will most likely not have sufficient momentum to trump Earth bound geopolitics.

The bright geostrategic spotlight of Apollo-*Soyuz* and the spirit of Détente that it represented was no more. Within the context of the space program, these hardening relations were reflected in each country's view of an emerging security dilemma caused by a new round of spaceplane technology.

The Space Shuttle vs. Buran Security Dilemma

In January of 1972, President Richard Nixon approved the development of the Space Shuttle program.[72] As a reusable vehicle capable of performing a variety of space missions in low earth orbit, the Space Shuttle was a radical departure from the cosmos exploratory visions of the Apollo program. The Shuttle's astronomically high initial costs were justified based on the long-term dramatic financial reductions to orbital launch costs. In order to produce this effect, utilization rate of the Space Shuttle were distorted to include mission rates as high as 50 launches per year.[73] The only strategy remotely capable of reaching these mission rates was to make the Space Shuttle

Figure 20: The Space Shuttle served as both a Military Spaceplane and Civil Spacecraft

Source: *NASA*, http://www.nikon.com/news/2005/0907_nasa_01.htm (Accessed 23 April 2011).

[72] David M. Harland, *The Story of the Space Shuttle*, (Chichester, UK: Praxis Publishing, 2004), 6.
[73] David M. Harland, *The Story of the Space Shuttle*, 3.

America's sole means of launching payloads to Earth orbit. Expendable boosters, such as Titan or Atlas, were considered redundant to the Space Shuttle capabilities and were therefore removed from service.[74] The DOD reluctantly agreed to this plan provided that the Space Shuttle met several stringent design requirements. For example, the DOD envisioned launching the Space Shuttle on operational responsive polar inclination military missions from Vandenberg Air Force Base.[75] The United States Air Force envisioned a dedicated DOD Space Shuttle; serviced and launched from Vandenberg's Air Force Base's Space Launch Complex 6 originally built for the MOL program.[76] Defense Department requirements also mandated the design of the Space Shuttle's large delta wings to preserve sufficient cross-range flight capability to land at Vandenberg or Edwards Air Force Base after one polar orbit.[77] In addition, the design of the Shuttle's large 60' by 15' cargo bay was a direct result of the Defense Department's specifications to carry the largest and heaviest National Reconnaissance Office (NRO) satellites to orbit.[78]

The Department of Defense also stipulated maintaining a large military presence within the astronaut corp to facilitate the execution of classified missions. For the first decade of Space Shuttle operations, the United States Air Force and National Reconnaissance Office detailed

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[74] The Department of Defense was never completely comfortable with relying upon the Space Shuttle as the primary means of launching defense payloads to orbit. While expendable boosters were discarded from use during this era, many within the defense establishment advanced expendable booster development quietly. In wake of the Space Shuttle Challenger disaster, the USAF removed the majority of DoD payloads from the Space Shuttle, canceled plans to launch the Space Shuttle from the Vandenberg launch complex, and returned expendable boosters, such as Atlas and Delta back to service.

[75] National Aeronautics and Space Administration, *Columbia Accident Investigation Report*, (Washington, DC: NASA, August 2003), 22.

[76] David M. Harland, *The Story of the Space Shuttle*, 6.

[77] National Aeronautics and Space Administration, *Columbia Accident Investigation Report*, (Washington, DC: NASA, August 2003), 10.

[78] National Aeronautics and Space Administration, *Columbia Accident Investigation Report*, 10.

several military officers to the NASA astronaut office under the Manned Spaceflight Engineer (MSE) program.[79] Different from career astronauts recruited from the military services, MSEs were DOD military officers specially detailed to NASA to be payload specialists aboard classified space shuttle missions.[80] Overall, 32 MSEs were selected by the USAF. However, internal friction between NASA and the DOD over the classified payload specialist program greatly reduced the role of the MSEs. Low shuttle launch rates, and the return of the DOD to using expendable boosters following the Challenger disaster resulted in the spaceflight of only 2 of the original 32 MSEs.[81] Ultimately, the Space Shuttle flew only 11 dedicated classified missions between its inaugural flight in April of 1981 and final military mission in 1992. These were primarily directed at the launch of classified satellites from the Space Shuttle's cargo bay and classified surveillance experiments.[82] By far, the vast majority of Shuttle missions were dedicated to scientific research and civil purposes.

Figure 21: First Class of Military Spaceflight Engineers

Gary Payton, 2nd from left in the front row, was the only member from this class to fly. He is now the Deputy Under-Secretary of the Air Force for Space Programs

Source: *USAF*, "The Manned Spaceflight Engineer Program," http://epizodsspace.testpilot.ru/bibl/spaceflight/31/mse.html, (Accessed 25 April 2011)

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[79] Michael Cassut, "Secret Space Shuttle", *Air and Space Smithsonian*, http://www.airspacemag.com/space-exploration/Secret-Space-Shuttles.html, 1 August 2009 (Accessed 10 March 2011).
[80]Michael Cassut, "Secret Space Shuttle", *Air and Space Smithsonian*, http://www.airspacemag.com/space-exploration/Secret-Space-Shuttles.html, 1 August 2009 (Accessed 10 March 2011).
[81] Michael Cassut, "Secret Space Shuttle," *Air and Space Smithsonian*, 1 August 2009, http://www.airspacemag.com/space-exploration/Secret-Space-Shuttles.html (Accessed 10 March 2011).
[82] Michael Cassut, "Secret Space Shuttle," *Air and Space Smithsonian*, 1 August 2009, http://www.airspacemag.com/space-exploration/Secret-Space-Shuttles.html (Accessed 10 March 2011).

Despite becoming an amazing testament to American technological accomplishment, the Space Shuttle proved to be far less operational resilient and tremendously more expensive than originally planned. For example, current NASA estimates place the cost of a single Space Shuttle launch at $450 million.[83] Independent estimates currently place this figure at closer to $1.5 billion per launch once the costs of infrastructure and overhead amortize over the life of the Space Shuttle program.[84] Either figure, however, is wildly above the initial 1972 estimate of approximately $40 million per launch in 2010 inflation adjusted dollars.[85] This huge ballooning in costs are directly attributable to the vast complexity of the Space Shuttle vehicle and program infrastructure, as well as gross underestimates of vehicle processing turnaround times between missions. As a result, far from estimates of one Space Shuttle launch per week, the Space Shuttle averaged only approximately four launches per year over its three decade history. This paucity in launch rate further accelerated overall launch cost per mission. Ultimately, these huge increases in cost coupled with a lack of operationally responsive space lift condemned the military utility of the Space Shuttle. Nonetheless, fear of the military potential of the Space Shuttle shocked the Soviet space program to produce a shuttle of its own.

The Soviets viewed the Space Shuttle as a super Dyna-Soar like strategic weapon. By examining the nearly fictional Space Shuttle cost and utilization projections in the 1970s, the Soviets suspected a public rouse to conceal a secret military use for America's new space plane.

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[83] "NASA Space Shuttle and International Space Station Frequently Asked Questions," http://www.nasa.gov/centers/kennedy/about/information/shuttle_faq.html, *NASA*, , (Accessed 18 May 2011).
[84]Roger Pielke Jr and Radford Byerly, "Shuttle Programme Lifetime Cost," *Nature*, 7 April 2011, http://rogerpielkejr.blogspot.com/2011/04/space-shuttle-costs-1971-2011.html (Accessed 22 May 2011).
[85] National Aeronautics and Space Administration, *Columbia Accident Investigation Report*, (Washington, DC: NASA, August 2003), 22.

From the Soviet perspective, the Space Shuttle's true purpose was to serve either as an orbital nuclear bomber, or as a military spaceplane capable of capturing, examining, or disabling Russian military satellites.[86] As a counter to this supposed threat, the Soviets engaged on a $15 billion ruble crash development program to develop *Buran* (Snowstorm).[87]

The design similarity between Buran and the Space Shuttle was a direct reflection of Soviet fears. Rather than investing in a design specifically tailored to Russian needs, the Soviet space program found it more expedient to copy the openly available design specifications of the US Space Shuttle.[88] This strategy allowed the Soviets to match US capabilities, even if they were unsure as to the exact strategy the US intended for the Space Shuttle.[89] However, *Buran* featured some changes over the Space Shuttle, namely a fully autonomous flight capability and the provision for two remote manipulator system arms to aid in the capture and exploitation of American satellites. However, the

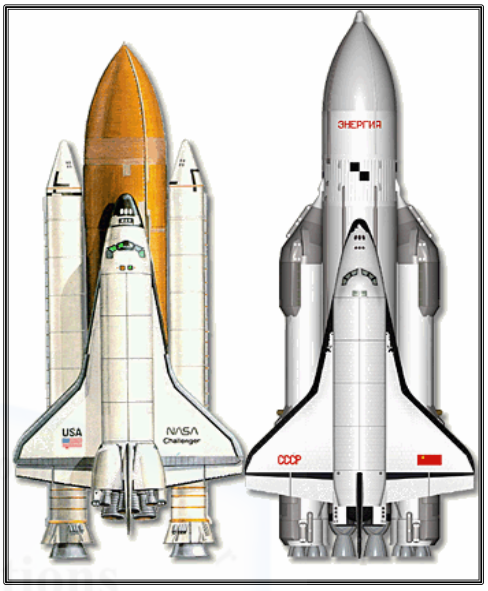

Figure 23: Shuttle vs. *Buran* Design

Source: "Buran Orbiter," *Russian Space Agency*, http://www.buran.ru/htm/molniya5.htm (Accessed 14 April 2011).

Figure 22: *Buran's* Autonomous Landing at Baikonur following its First, and Only, Orbital Flight

Source: "Reentry of the Buran Space Shuttle," *Russian Space Agency*, http://www.columbiassacrifice.com/pages_support/$buran.htm (Accessed 18 May 2011).

[86] Bart Hendrickx and Bert Vis, *Energiya-Buran*, 32.
[87] William E. Burrows, *This New Ocean*, 517.
[88] William E. Burrows, *This New Ocean*, 517.
[89] David M. Harland, *The Story of Space Station MIR*, 317.

Soviet approach of developing a means without an end proved their undoing. After only one uninhabited flight lasting two orbits, the *Buran* program collapsed with the implosion of Soviet communism. Despite the Soviet's amazing technical accomplishment, the end of the Cold War undercut the fundamental fear that provoked the need for *Buran*.[90]

Conclusions

Fear as a motivator for human spaceflight in state grand strategy presents several important lessons for a strategist. The most important concerns the gross mismatch between the glacially slow development of military human spaceflight programs and the blazingly fast pace of change in global security dynamics. While these military human spaceflight programs were technically sound and held promise for addressing national security fears, they all suffered from high cost and schedule paralysis. Since the birth of the space program, Earth bound spiraling security dilemmas fueled rapid changes in weapons and surveillance technology that often rendered national defense human spaceflight programs obsolete on the drawing board. The vast complexity and cost of human spaceflight, coupled with poor management, resulted in tenuous political support at best. The shorter development cycle of ICBMs and surveillance satellites made uninhabited systems a much more viable and attractive alternative to address changing security conditions. For much lower costs,

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[90] Bart Hendrickx and Bert Vis, *Energiya-Buran*, 385-392.
The fate of the Soviet Buran Shuttles reads like a Greek tragedy. Of the 5 *Burans* built by the Soviets, only 1 flew in space. This *Buran*, designated 1K, was destroyed in 2002 during a storm when the hangar it was stored in collapsed on top of it. Of the remaining *Burans*, BTS-002, was leased by a private group of investors and became a static display at numerous public events including the Sydney Olympic games in 2002. However, legal and financial disputes between various private organizations resulted in BT-002 languishing in limbo in a Bahraini junkyard. It remains there today. The *Buran* designated as OK-M is now a tourist attraction in Gorky Park. Visiting tourist are seated in the former cargo bay, now a multi-seat movie theater, and treated to images and videos highlighting the past glory of the Soviet space program. The electrical test bed *Buran*, designated OK-KS, and test model *Buran*, designated OK-TVI, remain indefinitely in partially disassembled storage in Russia.

uninhabited systems swiftly outpaced the capabilities and flexibility of equivalent human spaceflight programs for the missions of intelligence, surveillance, and strike. This trend makes the current paradigm of human spaceflight development ill suited for direct national security applications.

Second, the history of the Apollo-*Soyuz* Test Project disproves the often-held myth that peace and cooperation in space yield peace and cooperation on Earth. Instead, harmony in space must be the natural outgrowth of global accord on Earth, not the other way around. The tremendous success of ASTP could not overcome the inertia of fear, distrust, and global ambition between the United States and the Soviet Union.

Third, fear can accelerate state actions to distort enemy intentions and capabilities far beyond the bounds of reality. The security dilemma nightmares of the state can force rash decisions. As a result, hyper focus on national defense at the expense of the long term health of the entire governmental system is foolish. The high costs and development time associated with human spaceflight programs greatly magnify the impact of this vicious cycle. For example, the obsessive paranoia over the perceived doomsday mission of the Space Shuttle in the communist world contributed to the economic collapse of the Soviet Union. The feverish design and construction of *Buran*, no matter its technical merits, proved wholly ill conceived and was virtually stillborn after only one flight. Spacepower strategist must therefore be especially wary of the tendency for strategic overreach with respect to human spaceflight.

Despite this checkered past, the last important lesson for a strategist is that fear does create the impetus for an amazing pace of technological spacepower development. Specifically, the added risk associated with human spaceflight creates added incentive for robust

spaceflight systems that can have lasting spin-off benefit for society. For example, development work for Dyna-Soar led to technologies useful for the Space Shuttle; the backbone of America's space program for the previous three decades. *Almaz* developments led to the evolution of *Salyut* and *Mir*; space stations that have greatly contributed to human bio-medical and long duration spaceflight experience and understanding.

Thus, state fear of an existential threat as defined by Thucydides' provides a strategic window for tremendous growth in technical prowess. Strategists must always be cautious, however, to balance this opportunity against the realities of the geostrategic security and the ever-present specter of escalating costs. Furthermore, spacepower strategists must be creative in shaping opportunities for the achievement of state goals in the absence of an existential threat. By the late 1980s and 1990s, human spaceflight in particular, increasingly became a tool for advancing state interests as opposed to protecting states from doomsday.

Chapter 3

A *STRANGE* SPACE ODYSSEY

The Marriage of space stations to national interests: 1977-2010

> *When I was flying missions in Vietnam in 1969 as an F-4 pilot, I thought that there was an excellent chance that at some point in time I'd have interactions with the Russians, but I thought it would be of a somewhat different nature than they turned out. If anyone in 1969 had ever told me that I would wind up having a captain in the Russian force as a commander, I would have said, 'You're crazy.'*
>
> Norman Thagard, USMC Captain (ret.), 1st US astronaut to crew the Russian space station *Mir*

Thucydides' notion of national interest encompasses a state's quest for advantage, profit, and benefit. During the late 1970s and beyond, the American and Soviet pursuit of state interest resulted in a tremendously uncanny array of international relationships. In the early half of this era, both nations turned to space stations as a means to consolidate influence within each state's respective political alliances. By the late 1980s and early 1990s, as small tears in the Iron Curtain ripped apart into gaping holes, the utility of space stations morphed into a method to globally sponsor cooperation, generate wealth, and expand influence. This trend slowly helped to transform arch Cold War rivals into globalization allies. Understanding the international and domestic backdrop for the odyssey's of *Salyut* 6 and 7, Space Station Freedom, the Shuttle-*Mir* program, and the International Space Station helps to highlight this strange marriage between space station technology and national interest.

Ambassador *Salyut*

The *Salyut* program, in addition to bolstering Soviet scientific efforts and serving as a cover for the secret military *Almaz* program, also performed a unique political function. Key to the fulfillment of this political purpose was the technical design of *Salyut* 6 and 7. These two space stations featured a new two port docking system that allowed long-term crews to accept visitors. The short-term crew could dock with the station, perform a mission lasting approximately a week, return to Earth using the older *Soyuz* capsule, and leave the newer *Soyuz* capsule as a lifeboat for the long-term crew.[1] This deign feature enabled the *Inter-Kosmos* and *GlavKosmos* programs; a series of flights in which the Soviets flew guest cosmonauts from foreign states in a strategic effort to advance national interests.[2]

Figure 24: *Salyut* with Docked *Soyuz*

The 2nd Docking Port is Open at the Top of Picture

Source: "Salyut Program," *Russian Space Agancy*, http://reference.findtarget.com/search/Salyut%20program/ (Accessed 28 April 2011).

Salyut 6, launched on 29 September 1977, became the first station to host a guest flight engineer cosmonaut under the *Inter-Kosmos* program.[3] Czechoslovakia's Vladimir Remek, Czech air force pilot and the son of a high-ranking Czech defense minister flew to *Salyut* 6 on the tenth anniversary of the Soviet invasion of Czechoslovakia.[4] As

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[1] Roger D. Launius, *Space Stations: Base Camps to the Stars* (Washington DC: Smithsonian, 2003), 101.
[2] Philip Baker, *The Story of Manned Space Stations* (Chichester, UK: Praxis, 2007), 62.
[3] Nicholas L. Johnson, *Handbook of Soviet Manned Space Flight*, (San Diego, CA: Univelt, 1980) 252.
[4] David M. Harland, *The Story of Space Station Mir* (Chichester UK: Praxis, 2005), 65.

stated by international relations professor Michael Sheehan, the political purpose of the flight was to, "emphasize the closeness of Soviet-Czechoslovakia cooperation and the USSR recognition of Czechoslovakia as a sovereign equal of the USSR within the Warsaw alliance."[5] Both the host Russian government and the Russian supported Czech government of Gustav Husak needed this symbolic flight to shore up legitimacy given the controversial nature of the Soviet 1968 military invasion of Czechoslovakia.[6] After Remek's flight, additional Warsaw pact guest cosmonauts were flown from the nations of Poland, East Germany, Bulgaria, Hungary, and Romania.[7] The *Inter-Kosmos* program was also used as a tool to demonstrate solidarity with fraternal communist nations outside of the Eastern bloc. As testament to this goal, the Soviets flew Vietnam's Colonel Pham Tuan in July 1980, the world's first Asian astronaut, as well as Cuban Colonel Arnaldo Tamayo in September of 1980, the world's first astronaut of African heritage.[8] In later years, as the *Inter-Kosmos* program expanded to include the *Mir* space station, the Soviets also flew the world's first Afghani astronaut, Abdul Ahad Mohmand.[9] Mohmand's 1988 flight was an obvious attempt by the Russians to buttress the deteriorating political and military situation caused by the Soviet invasion of Afghanistan.

Figure 25: Crew of *Soyuz* 38 with Colonel Tamayo

Source: "First Black Man in Space," *Russian Space Agency*, http://www.waterholes.com/~dennette/salyut6.htm,(Accessed 28 April 2011).

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[5] Michael Sheehan, *The International Politics of Space* (New York, NY: Routledge, 2007), 57.
[6] Michael Sheehan, *The International Politics of Space*, 60.
[7] David M. Harland, *The Story of Space Station Mir*, 70-102.
[8] Michael Sheehan, *The International Politics of Space*, 60.
[9] "Abdul Ahad Mohmand: The First Afghan in Space," http://www.afghan-network.net/Culture/afghanastronaut.htm (Accessed 15 March 2011).

In a somewhat unusual arrangement, non-communist nations also participated in the *Inter-Kosmos* program for reasons generated by national self-interest. In a move to demonstrate independence from the United States dominated western alliance, France agreed to a *Salyut* flight in 1981. France's deputy head of the space program justified this decision when he stated, "the Soviet Union is a great space power, which possesses immense technical and scientific possibilities, we are very satisfied with the development of this cooperation, if not for it we would have to substantially reduce our program."[10] The Soviet Union also brokered an *Inter-Kosmos* arrangement with India to fly Indian Squadron Leader Rakesh Sharma to the *Salyut* 7 space station in 1984.[11] From the Soviet perspective, developing a relationship with the most influential state along the Indian Ocean could potentially fracture the unity of global democracies, demonstrate the virtues of Soviet communism to a powerful non-aligned state, and strategically offset the growing influence and relationship between China and Pakistan.[12] For India, the surge of domestic pride and unity generated by laying claim to its own astronaut was tremendously alluring. Similar arrangements were organized under the expanded G*lavKosmos* program, which featured guest flights on *Salyut* 7 and *Mir* from nations such as Austria, Japan, and the United Kingdom.[13]

Hence, flights to Soviet space stations under the *Inter-Kosmos* and *GlavKosmos* programs served political and economic goals of many nations seeking their own national interests. The spirit of this program was captured best by space historian James Oberg when he wrote, "The USSR was seeking more practical gains from its space program, in a sense initiating a new space race, not for honor, or even curiosity, but

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[10] Michael Sheehan, *The International Politics of Space,* 61.
[11] David M. Harland, *The Story of Space Station Mir, 122-123.*
[12] Michael Sheehan, *The International Politics of Space,* 61.
[13] Philip Baker, *The Story of Manned Space Stations, 62.*

for wealth and power."[14] Using a space station to advance national interest was a phenomenon used by the United States as well.

The Promise of Freedom

In the post-Apollo era, NASA conceived dreams of constructing a veritable constellation of space stations. By 1975, the space agency hoped to have at least one 12-person space station orbiting the Earth.[15] Expanded plans called for additional space stations in orbit over the Earth and the moon featuring crew sizes as high as 100 people.[16] In this original vision, the Space Shuttle's purpose would be to construct and service these stations. Despite President Nixon disapproval of this plan, and the subsequent redesign of the Shuttle to accommodate multiple competing requirements from the civil and defense sectors, these space station goals never completely died within NASA. Hence, following the successful opening flights of the Space Shuttle program, the goal of a permanent American space station resurfaced. This time, however, rather than only appealing to the purely scientific or exploratory capabilities of such a station, NASA administrator James Beggs was careful to develop an argument for an American space station matched to national interests as envisioned by President Ronald Reagan.

Figure 26: President Ronald Reagan shows a Space Station Freedom model to British Prime Minister Margaret Thatcher

Source: Ronald Reagan Library, http://www.aip.org/history/newsletter/spring2005/reagan.htm, (Accessed 26 April 2011)

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[14] Michael Sheehan, *The International Politics of Space,* 62.
[15] National Aeronautics and Space Administration, *Columbia Accident Investigation Report*, (Washington, DC: NASA, August 2003), 21.
[16] National Aeronautics and Space Administration, *Columbia Accident Investigation Board Report*, 2003, 21.

On 1 December 1983, Beggs argued to the President and the Cabinet Council on Commerce and Trade that a space station, designed from the outset to include contributions from the international community, could rally the political and economic strength of America and its allies.[17] Spin-off technologies from the space station could enhance the capabilities of Reagan's vaulted Strategic Defense Initiative as well as counter the technological advantages the Soviets enjoyed from their *Salyut* stations.[18] Such efforts would bolster America's overall leadership globally and diminish the strength and influence of the Evil Empire. Reagan became convinced of the tie between a space station and US interests and directly addressed the newly dubbed Space Station Freedom in his 1984 State of the Union Address.

> Tonight, I am directing NASA to develop a permanently manned space station and to do it within a decade. A space station will permit quantum leaps in our research in science, communications, in metals, and in life saving medicines which could only be manufactured in space. We want our friends to help us meet these challenges and share in their benefits. NASA will invite other countries to participate so we can strengthen peace, build prosperity, and expand freedom for all who share our goals.[19]

However, Space Station Freedom never garnered broad political support and funding despite President Reagan's endorsements and Administrator Beggs impassioned plea. Program management and technical challenges resulted in a ballooning of the station's initial price tag from $7 billion to over $30 billion.[20] As a result, congressional advocacy was difficult to marshal amidst the exploding national debt

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[17] Roger D. Launius, *Space Stations: Base Camps to the Stars* (Washington, DC: Smithsonian, 2003), 120.
[18] Roger D. Launius, *Space Stations: Base Camps to the Stars*, 120.
[19] "President Ronald Reagan 25 January 1984 State of the Union Address," *Federalism and the new Conservatism*
"http://reagan2020.us/speeches/state_of_the_union_1984.asp (Accessed 20 March 2011).
[20] Roger D. Launius, *Space Stations: Base Camps to the Stars, 136.*

crisis and lack of a perceived imminent need for a space station.[21] Diplomatically, international support and contributions from the European Space Agency, Canada, and Japan proved unwieldy to manage due to disagreements over requirements, technical strategy, and cultural misunderstandings.[22] Support from the scientific community waned as frantic redesigns of the station to manage cost, satisfy multiple disparate customers, and mitigate schedule problems resulted in dramatically reduced capability.[23] Secretary of Defense Casper Weinberger, one of Space Station Freedom's most vocal critics, lambasted the program from the outset as a political boondoggle with limited utility and extravagant costs.[24]

Ultimately, Space Station Freedom languished and died on the drawing board after costing the US taxpayer $11 billion.[25] Grandiose visions of championing US national interest through technological, political, and economic harmony went unrealized. Instead, Space Station Freedom barely lurched American interest forward by producing approximately 75,000 domestic jobs for an ailing aerospace industry and maintaining lukewarm relationships with partner nations.[26] Roger Launius, former NASA chief historian, eulogized the political lesson of Space Station Freedom best when he wrote, "It was a fairly simple undertaking for dictators, emperors, pharaohs, and kings to dictate the plans and means for impressive public monuments. But a modern democratic republic such as the United States has trouble with similar complex tasks."[27] Nonetheless, the technical, political, and international cooperation lessons learned from the Space Station

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[21] William E. Burrows, *This New Ocean* (New York, NY: Random House, 1999), 594.
[22] Roger D. Launius, *Space Stations: Base Camps to the Stars, 136-137.*
[23] Philip Baker, *Manned Space Stations*, 95.
[24] Roger D. Launius, *Space Stations: Base Camps to the Stars,* 121.
[25] Philip Baker, *Manned Space Stations*, 95.
[26] Roger D. Launius, *Space Stations: Base Camps to the Stars,* 133.
[27] Roger D. Launius, *Space Stations: Base Camps to the Stars,* 141.

Freedom project would prove critical to advancing the national interests of the US. The original national strategic aims of Space Station Freedom would be resurrected from the ashes as a tool of national interest following tectonic shifts in geopolitical context beginning in the late 1980s.

Shuttle-*Mir* and ISS as tools for Globalization and Wealth

In August of 1991, agents loyal to the KGB placed Premier Mikhail Gorbachev under house arrest while he was vacationing in his summer dacha in the Crimea.[28] A coup was underway in Moscow to rekindle the scant remnants of the once mighty Soviet system. Old guard communist hardliners, dismayed at the lack of response to the 1989 fall of the Berlin Wall and earlier disillusion of the Warsaw Pact, saw Gorbachev's *Perestroika* (Restructuring) and *Glasnost* agendas as politically, ideologically, and economically threatening.[29] However, the ponderous inertia of backwardness, corruption, obsolescence, and social depravity endemic in the Soviet Union had reached a critical mass no longer sustainable despite the efforts of the coup plotters. The Soviet Union quickly collapsed, stalled deeply in disorder and chaos, and emerged from the wreckage as a weakly bound Commonwealth of Independent States (CIS). This catastrophic and sudden implosion created a tremendous opportunity for both America and the CIS to use human spaceflight as a means to advance political agendas, generate wealth, enhance scientific knowledge, and address a menacing new national security problem.

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[28] Serge Schmemann, "The Soviet Crisis: Gorbachev reportedly Arrested in the Crimea", *NY Times*, 21 August 1991, http://www.nytimes.com/1991/08/21/world/the-soviet-crisis-gorbachev-reportedly-arrested-in-the-crimea.html (Accessed 15 March 2011).

[29] Lewis Siegelbaum, "1985: Perestroika and Glasnost", http://www.soviethistory.org/index.php?page=subject&SubjectID=1985perestroika&Year=1985, *Seventeen Moments in Soviet History* (Accessed 14 March 2011).

United States senior officials were fearful that the chaotic collapse of the Soviet Union created the environment in which former Soviet rocket and nuclear scientists and engineers would be tempted to sell hardware and expertise on the black market to the highest bidder.[30] Uncertainty as to the geopolitical impacts caused by the former Soviet Union's sudden loss of esteem, empire, and military prowess generated even greater calls to carry the newly formed CIS through the early stages of government and ideological transition.[31] A new alliance with former Cold War enemies offered the opportunity for an emerging economic market, cultural exchanges, and technology transfer. From the Russian perspective, the nascent post Soviet governments of Mikhail Gorbachev and his successor, Boris Yeltsin, needed to shore up legitimacy. Cooperation with the Americans offered the chance to garner lucrative financial agreements, gain international political support, and advance domestic unity goals. Within this context of national interest laid the motivational origins for both nations to cooperate through the Shuttle-*Mir* and International Space Station programs.

On 17 June 1992, Russian President Boris Yeltsin and American President George H.W. Bush issued a document with the unwieldy title of *Agreement between the United States of America and the Russian Federation Concerning Cooperation in the Exploration and Use of Outer Space for Peaceful Purposes*.[32] This agreement formalized a series of missions to *Mir* (Peace) by US astronauts, flights aboard the US Space Shuttle by Russian cosmonauts, and a single joint docking mission between *Mir* and the Shuttle during the 1994 to 1995 timeframe.[33] In 1993, recently sworn in US President William Clinton greatly expanded this original agreement as a centerpiece of his administration's overall

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[30] William E. Burrows, *This New Ocean,* 609.
[31] William E. Burrows, *This New Ocean,* 608.
[32]George C. Nield and Pavel Mikhailovich, *Phase 1 Program Joint Report*, NASA SP-1999-6108, January 1999, 2.
[33] Roger D. Launius, *Space Stations: Base Camps to the Stars,* 152.

strategy to sponsor global peace and cooperation. Under the new agreement, the 1992 plan was enlarged to include 10 dockings and five long duration missions.[34]

Furthermore, flights to *Mir* under this new program formed only the first phase of an ambitious multiyear three-stage process designed to promote long-term strategic cooperation. The guiding vision of this initial stage, Phase One, was to, "create the experience and technical expertise for an International Space Station," by bringing together, "the United States and Russia in a major cooperative and contractual program that takes advantage of both countries' capabilities." [35] Phase Two of this program would incorporate the former Soviet Union's space lift and technological expertise into the design and construction of a newly proposed International Space Station, Space Station Freedom's phoenix.[36] Phase Three envisioned long-term joint American and Russian flight operations aboard the International Space Station along with astronauts from other partner nations.[37]

Figure 27: Shuttle Atlantis Docked to Space Station Mir

Source: *NASA*, http://library.thinkquest.org/07aug/00861/issmir.htm , (Accessed 29 April 2011)

Within the United States, many political leaders were wary of this sweeping cooperative partnership with a nation under the grip of tumultuous volatility. A report from the US Congress Office of Technological Assessment cited numerous pitfalls including technical risk, unstable political institutions, instability of the Russian military, economic uncertainty in the Russian markets, crime and corruption

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[34] Philip Baker, *Manned Space Stations*, 99.
[35] George C. Nield and Pavel Mikhailovich, *Phase 1 Program Joint Report,* 3.
[36] Roger D. Launius, *Space Stations: Base Camps to the Stars,* 153.
[37] Roger D. Launius, *Space Stations: Base Camps to the Stars,* 153.

within Russian society, and impregnable cultural barriers.[38] Nonetheless, President Clinton's administration viewed the benefits as far outweighing the risks. NASA historian Roger Launius outlined these national interest benefits as:

1. Create a positive image of the United States in an international setting.
2. Encourage greater public interaction between the United States and Russia.
3. Reinforce the perception of American openness to outside nations.
4. Expand the use of space technology as a tool for diplomacy to serve broader US foreign policy goals.
5. Share financial cost and resource burdens while broadening technical expertise.[39]

Nonetheless, the resurrection of Space Station Freedom into the International Space Station, and the resultant commitment to incorporate the Russians into the project remained controversial. In the summer of 1993, the bill sponsoring this agreement passed the US House of Representatives by a 1-vote margin of 215 to 216.[40] Later, the bill survived the Senate by only 19 votes; the slimmest margin of any space station bill voted on by the Senate from 1991 to 1998.[41] The strength and commitment of the United States and Russia in achieving national interest goals using space stations would be sorely tested in the years to come.

During Phase One, Russian cosmonauts and American astronauts suffered many calamities aboard *Mir* that strained US political and public support for the program. While some bright spots existed, such as astronaut Shannon Lucid's record-breaking flight and hero's welcome

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[38] US Congress, Office of Technological Assessment, *US Russian Cooperation in Space*, OTA-ISS-618 (Washington DC: Government Printing Office, April 1995), 11.
[39] Roger D. Launius, *Space Stations: Base Camps to the Stars,* 158-159.
[40] "NASA's Space Station Program: Evolution and Current Status", *NASA*, 4 April 2001, http://history.nasa.gov/smith.htm (Accessed 13 March 2011).
[41] "NASA's Space Station Program: Evolution and Current Status", *NASA*, 4 April 2001, http://history.nasa.gov/smith.htm (Accessed 13 March 2011).

from President Clinton upon returning to Earth, the overall American perception of the viability of the program was tepid.[42] Reports of cultural miscommunications, numerous power and computer failures, an on-board fire from a chemical oxygen generator, and near miss with a resupply cargo vehicle served to corrode domestic US support and bring to question the achievability of US national interests.[43] The seminal event that brought these issues to the international forefront was the 1997 disastrous collision between *Mir* and a Progress resupply vehicle that nearly caused a loss of the entire station and an emergency evacuation by the crew.[44]

In the aftermath of the collision, criticisms erupted accusing the Russians of lackadaisical safety protocols and of covering up problems in the hopes of bilking the United States for continued financial support. US Congressional Representative James Sensenbrenner, chairperson of the House Science Committee, decried US leadership to, "reexamine the balance of value versus risk."[45] However, despite calls to end American and Russian cooperation in space, the need to keep the Russian Federation peaceably involved with the international community, US desires to maintain political leverage for arms control, and NASA's wishes to use *Mir* as a platform to learn about long duration spaceflight overrode waves of domestic criticism.[46]

Later, the United States would site similar reasons to justify continued commitment in the face of crippling delays, broken promises, and cost overruns caused by the Russians during the construction of the ISS. Specifically, the Russians were tasked with building and launching the critical first module of the ISS known as the Functional

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[42] Philip Baker, *Manned Space Stations*, 106.
[43] Roger D. Launius, *Space Stations: Base Camps to the Stars,* 166.
[44] David M. Harland, *The Story of Space Station Mir*, 264-269.
[45] William E. Burrows, *This New Ocean,* 606.
[46] William E. Burrows, *This New Ocean,* 606-609.

Cargo Block or *Zarya* (Sunrise). Without *Zarya*, the remainder of the space station could not be built and the ISS would be in danger of cancelation.[47] Production difficulties within Russia caused *Zarya's* initial cost estimate to US taxpayers to skyrocket from $190 million to $600 million.[48,49] Subsequently, *Zarya's* launch date slipped by over 7 months causing significant schedule delays to the remainder of the program.[50] Stifling problems of this type between the United States and Russia over the construction of the ISS compounded an already soured relationship from the Shuttle-*Mir* program. Space policy analyst Marcia Smith captured US attitudes towards the Russian during a 2001 congressional testimony when she said, "From the beginning, challenges arose with the Russian's participation. Many promises were made by high ranking government officials that sufficient funding would be provided to fulfill Russian commitments to the ISS. Most were not kept."[51]

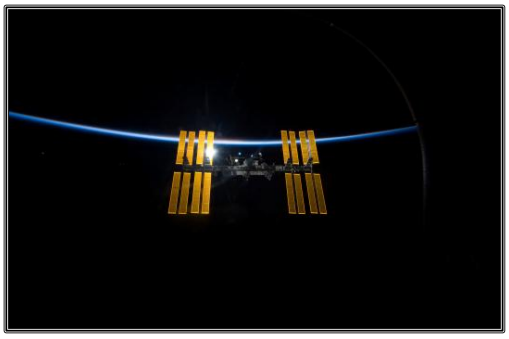

Figure 28: The International Space Station serves as an Instrument of State Soft Power to Promote National Interests

Source: NASA, Abby Cessna, *Universe Today*, 25 January 2010, http://www.universetoday.com/52067/international-space-station/ (Accessed 1 May 2011).

Despite the rough political and economic difficulties, US participation with the Russians for both the *Mir* and ISS programs has yielded important benefits. Mainly, US national interests were met in terms of fostering cooperation with the Russian coalition. The ISS in particular has become a means with which to merge both the technological and cultural aspects of several nations across the world.

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[47] Roger D. Launius, *Space Stations: Base Camps to the Stars,* 183-184.
[48] Roger D. Launius, *Space Stations: Base Camps to the Stars,*185.
[49] William E. Burrows, *This New Ocean,* 607.
[50] "ISS Zarya," *Astronautix*, http://www.astronautix.com/craft/isszarya.htm (Accessed 22 April 2011).
[51] Roger D. Launius, *Space Stations: Base Camps to the Stars,* 186.

The international cooperation required to construct the largest space station ever placed in orbit has served as a tool of overall state foreign policy. Utilizing space stations for political clout, however, is only but one method of advancing state interest.

Figure 29: American Businessperson Dennis Tito Became the First Private Space Tourist in 2001

Source: *Russian Space Agency*, 28 Apr 2011, http://moonandback.com/2011/04/28/space-tourism-turns-ten%E2%80%AC-miles-obrien-interviews-tito/ (Accessed 18 May 2011).

In a relatively recent twist on Thucydides' notion of state interests, space stations have also provided a means to generate commercial wealth for states under an emerging space tourism industry. For instance, the Tokyo Broadcasting System paid the Russian government $28 million to fly a Japanese journalist aboard *Mir* for a week in 1990.[52] Post 2001, the private company Space Adventures brokered several multi-million dollar agreements with the Russian government to fly such notable business professionals and space enthusiasts as Dennis Tito, Mark Shuttleworth, Richard Garriot, and Anousheh Ansari.[53] Recently, the Russian government sold two nearly completed space stations from the legacy *Almaz* military program to the private company Excalibur *Almaz* for potential use as commercial destinations in space.[54] The Russian Space Agency's current prices for private flights to the International Space Station remain exorbitantly high at approximately $40 million per

[52] David M. Harland, *The Story of Space Station MIR* (Chichester: UK, Praxis, 2005), 202.
[53] Anousheh Ansari, *My Dream of Stars* (New York, NY: Palgrave Macmillan, 2010), 96.
[54] http://www.excaliburalmaz.com/ (Accessed 26 April 2011).

ticket.[55] As a result, the pool of available customers for this luxury will remain extremely small. The long term viability of this business model, and subsequent potential for the achievement of state goals via the generation of commercial wealth, remains to be seen.

Conclusions

The history of *Salyut*, Space Station Freedom, Shuttle-*Mir* and the ISS give a strategist important insights into the viability of using human spaceflight as a tool to pursue national interests objectives. The most significant of these lessons is that human spaceflight can successfully achieve state interest, however the costs to do so can be extreme. The legacies of the Space Station Freedom, Shuttle-*Mir*, and the ISS demonstrate that nations should embark on human spaceflight partnerships for the potential benefits to state soft power, not for perceived improvements to program cost, schedule timeline, or vehicle performance. In addition, once states are committed to a multi-national space partnership, the diplomatic and political impacts of reneging may prove overwhelming. Hence, national leadership should not enter these partnerships lightly and must have a clear understanding as to the overall strategic ends.

Second, similar to the lessons learned from the analysis of human spaceflight for national security purposes, national interest based human spaceflight cannot remedy Earth problems. For instance, diplomatic partnerships enhanced by guest cosmonaut flights aboard the *Salyut* space station were unable to prevent the collapse of the Soviet Union or were unable to heal wounds between the Soviet Union and Afghanistan. Hence, human spaceflight for national interests can

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[55] Susan Kime, "Up We Go: Space Adventures for the Risk Tolerant Explorer," *Luxist*, 17 December 2010, http://www.luxist.com/2010/12/17/up-we-go-space-adventures-for-the-risk-tolerant-explorer (Accessed 20 May 2011).

only be effective if applied under sound and ethical principles of statecraft.

Third, the impact of human spaceflight as a critical ingredient for the development of a science, technology, engineering, and mathematics (STEM) focused society cannot be overestimated. For the United States, President Barack Obama's 2011 State of the Union address most recently identified the significance of STEM as a vital national interest.[56] President Obama challenged the United States to remain technologically competitive with nations such as China and India and compared America's recent largesse in STEM as this generation's Sputnik moment.[57] The thread of President Obama's speech echoes similar initiatives dating back to the Eisenhower administration's pledge to bolster America's commitment to STEM in response to the technological threat posed by the Soviet Union. In this regard, human spaceflight remains a powerful catalyst for innovations in STEM. As evidenced by the surge in engineering career enrollment and scientific achievement in the 1960s as a result of the space race, a vibrant human spaceflight program can help stimulate advances in a state's overall technological prowess. The power of the human presence in space to inspire STEM innovation is apparent in the close intertwining of science and technology education with American space science fiction media and government efforts to popularize human spaceflight to schools through engineering competitions and NASA public relations initiatives. As a sound national scientific base is critical to the strength of a nation in an increasingly technological world, human spaceflight's role in encouraging STEM will continue to be an important factor in satisfying national interests.

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[56] President Obama's 2011 State of the Union Address, *The White House*, 27 January 2011, http://www.whitehouse.gov/state-of-the-union-2011 (Accessed 1 May 2011).
[57] President Obama's 2011 State of the Union Address, *The White House*, 27 January 2011, http://www.whitehouse.gov/state-of-the-union-2011 (Accessed 1 May 2011).

Last, the persistent allure and adventure of spaceflight offers a unique opportunity for the creation of a private commercial human spaceflight industry. Despite the extreme prices for flights to orbit, the pull of living a lifelong dream, experiencing weightlessness, and viewing the Earth as few have seen it continues to draw a small, but extremely wealthy, stream of enthusiastic adventurers. This opens the potential of using human spaceflight as a means to create wealth for a state. Although the dynamics of this industry are still emerging, it provides a tantalizing twist to the achievement of grand strategic goals. This aspect of human spaceflight holds special promise for the creation of innovation in the US space industry and a chance to develop a competitive edge against the rising influence of Chinese human spaceflight.

Chapter 4

HIDDEN DRAGON

Thucydides' concepts in shaping the Chinese human spaceflight program: 1953-2011

I will live up to the expectations of the motherland and the people, and will try my best to make every part of the mission successful.

Yang Liwei, PLAAF Lieutenant Colonel, 1st Chinese taikonaut in space

The Jiuquan Satellite Launch Center complex sits nestled in the remote reaches of China's Gobi desert. This region, made famous in the past by the Mongol empire and Silk Road trade, became the scene of yet another milestone in Chinese history. On 15 October 2003, loudspeakers broadcast the voice of an excited launch control officer reading the countdown to lift-off.[1] The sound of his voice reverberated across the open plains coloring the anticipation of the moment. As the words *San* (three)…*Er* (two)…*Yi* (one) echoed through the air, a Long March 2F booster thundered off the pad carrying a *Shenzhou* (Sacred Vessel) capsule. *Shenzhou's* occupant, People's Liberation Army Air Force (PLAAF) Lieutenant Colonel Yang Liwei, would

Figure 30: Launch of Shenzhou 5

Source: *Chinese Space Agency*, http://www.spacetoday.org/China/ChinaTaikonauts.html, (Accessed 23 April 2011).

[1] "Chinese Launch Could Signal New Space Race", *CNN*, 14 October 2003, http://www.cnn.com/2003/TECH/space/10/14/space.race/index.html?iref=allsearch (Accessed 20 March 2011).

achieve instant fame as China's first actual space voyager, or taikonaut.[2] With the historic launch of the *Shenzhou* 5 mission, China became only the third nation on Earth to possess a human spaceflight program. Many analogize China's entry into the high echelon of space faring nations as that of a hidden dragon poised ready to pounce on the mantle of space leadership. Hence, understanding the saga of Chinese human spaceflight through the analytical framework provided by Thucydides is important in developing a US space strategy for the future.

Origins

Similar to the United States and Russia, the Chinese human spaceflight program was born within the crucible of Cold War fears and the quest for honor. For China, the genesis of these two driving factors for a space program began in 1953 with US President Dwight Eisenhower's threat to end the Korean War using nuclear weapons.[3] Eisenhower's statement generated grave concern within China since the Chinese military was powerless to protect itself or deter the United States from escalating to nuclear violence. Following the war, the regional presence of large foreign military forces within South Korea and Japan fed Chinese qualms over meddling pressure from western powers. The 1954-1955 Quemoy-Matsu crisis along the China coast only served to accelerate Chinese concerns over US atomic diplomacy and growing western strategic influence.[4] From the perspective of communist Chinese leadership, China's regional interests and security would always be in jeopardy so long as China did not possess missile-borne nuclear weapons. Without this technology, communist China's strategic

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[2] Philip Baker, *The Story of Manned Space Stations* (Chichester:UK, Praxis, 2007), 146.
[3] Conrad C. Crane, *American Airpower Strategy in Korea: 1950-1953* (Lawrence, KS: University Press of Kansas, 2000), 164.
[4] Campbell Craig, *Destroying the Village* (New York, NY: Columbia University Press, 1998), 52.

goals of demolishing the remnants of the Nationalist government and reunifying Taiwan into China proper would be emasculated.[5] To rectify these security fears, Mao Tse-Tung, Chinese Communist Party Chairman, turned to the rocketry genius of Tsien Hsue-shen.

Hsue-shen was a Chinese born national who traveled to the US in 1911 on an aeronautical engineering scholarship to the Massachusetts Institute of Technology.[6] While in the US, Hsue-shen achieved great technical prominence as a *protégé* (apprentice) of Theodore Von Karman, research director of solid rocket propulsion at the Jet Propulsion Laboratory, and technical board member of the military team that interrogated Nazi rocket scientist following World War II.[7] However, Hsue-shen's Chinese origins brandished him as a communist threat to the United States under Senator Joseph McCarthy's purges during the early 1950s. With Hsue-shen's deportation, America's xenophobia proved a timely strategic bonanza for China. On 8 October 1956, Mao Tse-Tung announced Hsue-shen as the head of the National Defense Ministry's newly formed rocket program.[8] In this capacity, Hsue-shen became the Chinese equivalent of America's Dr. Werner von Braun or the Soviet Union's Sergei Korolev. Hsue-shen's steadfast, three-decade leadership

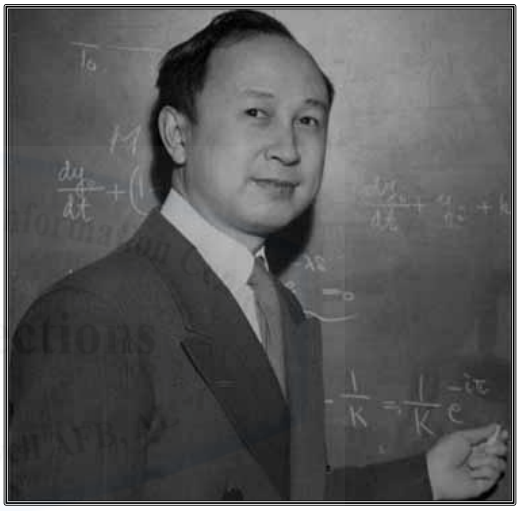

Figure 31: Tsien Hsue-shen, Father of the Chinese Space Program

Source: *MIT Museum*, http://museum.mit.edu/nom150/entries/1505, (Accessed 29 April 2011).

[5] Xiaoming, Zhang, *Red Wings over the Yalu* (College Station, TX: Texas A&M University Press, 2002), 213.
[6] Erik Seedhouse, *The New Space Race* (Chichester, UK: Praxis, 2010), 14.
[7] Erik Seedhouse, *The New Space Race,* 14.
[8] Brian Harvey, *China's Space Program: From Conception to Manned Spaceflight* (Chichester, UK: Praxis Publishing, 2004), 22.

in the face of astounding domestic challenges proved a critical factor in the achievement of Chinese national goals.

The primary strategic aim of the Chinese space program in 1956 was to grow regional power projection capability through the development of a medium range intercontinental missile. Soviet aid, in the form of selling the Chinese the Russian version of the captured German V2, was the critical first step of this process.[9] Simultaneous with this effort, China would also develop a nuclear weapon capable of delivery atop one of Hsue-shen's boosters. These fear based goals would expand less than a year later to include the Chinese desire to garner honor.

Inspired by the Soviet's successful launch of *Sputnik* in 1957, Mao ordered his nascent space program to launch a Chinese version of *Sputnik* to commemorate the tenth anniversary of the creation of the People's Republic of China in 1959.[10] However, Mao's extravagant visions of spaceflight for addressing fear and honor met with the tragic terrestrial realities of his Great Leap Forward program. Mao's "leap," designed to advance China from a backwards agrarian state into an industrial powerhouse, instead caused mass population upheavals, gross misallocation of natural resources, and a death toll estimated between 36 and 45 million.[11] An ideological split with the Russia's Premier Nikita Khrushchev in 1960 only added to the Chinese space program's woes by formally severing Soviet technical assistance.[12] Under this context, China's space program failed to achieve any its original objectives within the proposed timeline and nearly withered to death in the cradle.

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[9]"Tsien," *Astronautix*, http://www.astronautix.com/astros/tsien.htm (Accessed 21 March 2011).
[10] Brian Harvey, *China's Space Program: From Conception to Manned Spaceflight,* 25-26.
[11] Dikötter, Frank. *Mao's Great Famine: The History of China's Most Devastating Catastrophe, 1958-62.* (New York, NY:Walker & Company, 2010), 333.
[12] David Harvey, *China's Space Program: From Conception to Manned Spaceflight,* 34.

Nonetheless, China's weakened space program continued development; albeit at a much less ambitious pace. In 1960, Hsue-shen's defense ministry successfully flew the DF-1; the Chinese version of the German V2.[13] Four years later, in June of 1964, the Chinese successfully launched the indigenously designed DF-2; a rocket capable of striking Japan from Chinese soil.[14] Later that year, China detonated its first nuclear device. These two technologies finally merged on 27 October 1966 when the Chinese conducted an audacious live weapon flight test of a nuclear-armed DF-2.[15] In doing so, Hsue-shen's rocket technology helped to placate China's fears. The steady Sino advances in space technology also helped pave the way for China's first attempt at garnering honor through a human spaceflight program.

Taikonauts in the Dawn Light

With fear concerns abated by China's growing prowess with rocket and nuclear technology, Chairman Mao's concerns turned to developing international honor by using space technology. Impressed by the space exploits of the US and Soviet programs, Chairman Mao clandestinely approved plans for an indigenous Chinese human spaceflight program in March of 1966.[16] From Mao's perspective, flying humans in space was the ultimate stage to achieve superpower status, demonstrate technological acumen, and harvest international respect. Mao desperately desired these prestigious outcomes given his nation's political and ideological isolation from both the Soviet Union and the United States.

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[13] Iris Chang, *Thread of the Silkworm*, (New York, NY: Basic Books, 1995), 219.
[14] Iris Chang, *Thread of the Silkworm,* 222.
[15] Roger Handberg and Zhen Li, *Chinese Space Policy: A Study in Domestic and International Politics* (New York,NY: Routledge, 2007). 61.
[16] "Shuguang-1," *Astonautix*, http://www.astronautix.com/craft/shuuang1.htm (Accessed 23 March 2011).

Similar to the United States and Soviet human spaceflight emphasis on sociological virtues, recruitment for China's future taikonauts heavily reflected the Chinese cultural ethos under Mao Tse-Tung. Foremost, prospective candidates needed to have, "consistently expressed correct revolutionary thoughts and have a politically correct family background."[17] Only once past this hurdle were physical and professional skill considered. In addition, China's human spaceflight selection process, begun several years behind the Americans and the Soviets, benefitted by tailoring the best aspects of both systems to suit China's needs. As a mirror of the Soviet system, China only considered officer fighter pilots from line PLAAF units.[18] As a mirror of the United States system, the Chinese placed special additional emphasis on candidates with advanced technical schooling and special flight experiences above routine flight training time.[19] Interestingly, psychological examinations were not a part of the selection process as the study of psychiatry was banned under Mao's Marxists society.[20] From an initial pool of over 1000 candidates, 19 were ultimately selected on 15 March 1971 to become the initial taikonaut cadre of Project 714; China's secret codename for its human spaceflight project.[21] Almost all of the 19 possessed combat flight time with several having earned achievement medals for shooting down US surveillance drones over China during the ongoing Vietnam War.[22]

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[17]"Shuguang-1," *Astonautix*, http://www.astronautix.com/craft/shuuang1.htm, (Accessed 23 March 2011).
[18] A formal flight test school for the Chinese, in similar fashion to the USAF or USN test pilot school, did not exist in China until 2006. Test Pilot before this point were proficient line PLAAF pilots with minimal additional training for test work.
[19] "Shuguang-1," *Astonautix*, http://www.astronautix.com/craft/shuuang1.htm (Accessed 23 March 2011).
[20] "Shuguang-1," *Astonautix*, http://www.astronautix.com/craft/shuuang1.htm (Accessed 23 March 2011).
[21] Harvey, *China's Space Program: From Conception to Manned Spaceflight*, 242.
[22] "Shuguang-1," *Astonautix*, http://www.astronautix.com/craft/shuuang1.htm, (Accessed 23 March 2011).

The blueprint for Project 714's space vehicle was heavily based upon the American Gemini capsule design. Chinese engineers chose to adapt this design since America's choice of an open civil space program meant that US spacecraft designs were easily attainable. Furthermore, China considered the US Apollo and Russian *Soyuz* capsules as too advanced for their current technological state, but the American Mercury and Russian *Voshkod* capsules as too primitive to garner sufficient honor for the state.[23] Known as the *Shuguang* (Dawn Light), China's capsule would feature a two person crew and would launch atop a modified Long March 2A booster originally designed for reconnaissance satellites.[24] Once on orbit, the two-person crew would perform scientific research and military missions before de-orbiting and splashing down to a water landing.

Figure 32: Chinese Shuguang Design Based on the US Gemini Capsule

Source: Mark Wade, "Shuguang-1," *Astronautix*, http://www.astronautix.com/craft/shuuang1.htm (Accessed 21 April 2011).

However, Mao's ideological paranoia would again intervene to ensure that neither the *Shuguang* nor any of China's original 19 taikonauts would ever fly. By the mid 1960s, Chairman Mao grew more and more suspicious of supposed capitalist elements within the Chinese government conspiring to undermine socialist reforms.[25] In May of 1966, Mao instituted the Chinese Cultural Revolution, a program designed to restore Marxists ideals to Chinese society by actively

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[23] "Shuguang-1," *Astonautix*, http://www.astronautix.com/craft/shuuang1.htm, (Accessed 23 March 2011).
[24] "Shuguang-1," *Astonautix*, http://www.astronautix.com/craft/shuuang1.htm, (Accessed 23 March 2011).
[25] Roderick MacFarquhar and Michael Schoenhals, *Mao's Last Revolution* (Cambridge, MA: Harvard, 2006), 7-13.

purging non-communists.[26] Mao purges turned society against itself as suspicion and rampant distrust rotted China from within. Under this program, few within China's government or society were safe from accusations. Many leaders within China's human spaceflight program were falsely implicated as aiding a fictitious coup, and were summarily imprisoned, tortured, and executed.[27] As a result, Mao's purges devastated not only Chinese society, but destroyed China's human spaceflight program.

In the midst of the Cultural Revolution's ravages, Mao became dubious as to the utility of human spaceflight. He blamed failures of Project 714 on the lack of Tsien Hsue-shen's moral courage and deemed spaceflight as no longer significant to national goals.[28] Funding for Project 714 dried up and all personnel assigned to the program were returned to their original units by 3 May 1972.[29] As a further sad ending to the program, the Chinese, still envious of the national honor value of a thriving human spaceflight program, staged a mock public affairs release in January of 1980.[30] Photographs detailed Chinese space engineers designing a Skylab like space station and taikonauts training on a Space Shuttle like cockpit. None of these

Figure 33: Early Taikonauts in a Mock Space Plane Cockpit

Source: Chinese Space Agency, "Project 921: Chinese Human Spaceflight Program," 27 December 2010, http://sinodefence.wordpress.com/2010/12/27/project-921-chinese-human-spaceflight-programme/, Dragons in Space (Accessed 21 May 2011).

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[26] Roderick MacFarquhar and Michael Schoenhals, *Mao's Last Revolution,* 3.
[27] [27]"Shuguang-1," *Astonautix*, http://www.astronautix.com/craft/shuuang1.htm (Accessed 23 March 2011).
[28] [28]"Shuguang-1," *Astonautix*, http://www.astronautix.com/craft/shuuang1.htm (Accessed 23 March 2011).
[29] Brian Harvey, *China's Space Program: From Conception to Manned Spaceflight*, 243.
[30] [30]"Shuguang-1," *Astonautix*, http://www.astronautix.com/craft/shuuang1.htm (Accessed 23 March 2011).

programs actually existed and a goodwill trip to China by US astronauts Gordon Fullerton and Jack Lousma in 1982 confirmed the woefully dilapidated state of Chinese human spaceflight.[31] China's attempts at honor during this era harkened back to the Soviet Union's use of compensatory symbolism to distort realty into rhetoric.

Rebuilding of China's Spaceflight Technology

Following the death of Mao Tse-Tung in September 1976, China's new Premier, Deng Xiaoping instituted a new direction opposite from Mao's collectivism policies.[32] Xiaoping's Four Modernizations program for agriculture, industry, national defense, and science and technology actively encouraged capitalist overtones and open relations with outside nations.[33] Spaceflight, championed under the modernization banner of science and technology, focused on the development of commercial boosters and satellite technology to improve peasant economic and agricultural development, not on state desires to use human spaceflight for honor.[34] This dedicated focus in the absence of Mao's societal upheavals finally resulted in a respectably robust space lift capability and the development of an advanced family of Long March boosters. Over the following decade, China's use of the Long March to launch commercial satellites payloads for international customers proved to generate millions in profit for the Chinese economy.[35] With China's economic well being and space lift prowess greatly enhanced, efforts to resurrect human spaceflight resurfaced again in 1986.

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[31] "Project 921," *Air and Space Smithsonian*, 1 November 2002, http://www.airspacemag.com/space-exploration/Project_921.html (Accessed 25 March 2011).
[32] Erik Seedhouse, *The New Space Race*, 15.
[33] Erik Seedhouse, *The New Space Race*, 15.
[34]Roger Handberg and Zhen Li, *Chinese Space Policy: A Study in Domestic and International Politics* (New York,NY: Routledge, 2007), 86.
[35] Handberg and Li, *Chinese Space Policy: A Study in Domestic and International Politics*, 95.

Taikonauts in National Strategy Reborn

Under Project 863, created in 1986, the Chinese loosely proposed a series of crewed spaceplanes designed to service a scientific space station.[36] Presumably, the Chinese were interested in human spaceflight as a scientific exploration tool for national interest. Although 863 never made it beyond the planning stage, its research became the foundation for China's current human spaceflight program. Designated as Project 921 in 1992, this effort would combine the Long March booster technology developed for China's uninhabited space program with *Soyuz* capsule technology provided by Russia following the collapse of the Soviet Union.[37] From the Russian perspective, selling spaceflight hardware and expertise to the Chinese satisfied Russia's national financial interests. From the Chinese perspective, leveraging existing technology allowed a quick path to achieving national interest and honor goals. The result of this international relationship was the *Shenzhou* (Sacred Vessel) vehicle.

Shenzhou, like its Soyuz cousin, is comprised of three modules; a forward orbital module, a center reentry capsule, and an aft service module.[38] However, *Shenzhou* is significantly larger in internal volume to better accommodate

Figure 34: Shenzhou Spacecraft Cutaway

Source: Chinese Space Agency, *Daily Kos*, 1 March 2009, http://www.dailykos.com/story/2009/3/1/1643/74774/384/703374 (Accessed 27 April 2011).

[36] Brian Harvey, *China's Space Program: From Conception to Manned Spaceflight*, 247.
[37] Brian Harvey, *China's Space Program: From Conception to Manned Spaceflight*, 247.
[38] Erik Seedhouse, *The New Space Race*, 175.

crews of up to three people for extended missions.[39] Furthermore, the *Shenzhou* orbital module differs from Soyuz in that it features its own power, propulsion, and autonomous flight capability.[40]

Hence, unlike *Soyuz*, *Shenzhou's* orbital compartment is capable of remaining on orbit independent of the re-entry and service modules. Therefore, *Shenzhou's* orbital modules can serve as mini-space station destinations for other *Shenzhou* re-entry and service capsules. These design features reflect China's national aim of quickly developing a permanent presence in space.

The *Shenzhou* and Long March booster combination underwent a series of uninhabited test flights from 1999 to 2002.[41] These flights ultimately culminated in *Shenzhou* 5's historic launch in 2003. Taikonaut Liwei remained on orbit for over 21 hours and successfully demonstrated China's ability to launch, track, and recover humans in space.[42] Domestic elation and international praise following *Shenzhou* 5's flight were tremendous. Chinese President Hu Jintao hailed the event as, "an honor for our great motherland, an indicator for the initial victory of the country's first human spaceflight and for a historic step taken by the Chinese people in their endeavor to surmount the peak of the world's science and technology."[43] Like Gagarin, Liwei was touted by the Chinese government as a paragon of Chinese ideals and was used as a symbol to promote domestic agendas and international goodwill.

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[39] Erik Seedhouse, *The New Space Race*, 175.
[40] Erik Seedhouse, *The New Space Race*, 176.
[41] Erik Seedhouse, *The New Space Race*, 174.
[42] "Yang Liwei: China's First Astronaut," *China.org*, http://www.china.org.cn/china/shenzhouVII_spacewalk/2008-09/12/content_16440252.htm, (Accessed 25 March 2011).
[43] "Status of Shenzhou 5 Spacecraft," *Spaceflight Now*, http://spaceflightnow.com/shenzhou/status.html, (Accessed 23 March 2011).

Shenzhou 5 was followed up by *Shenzhou* 6 in 2005; a two person taikonaut mission that remained on orbit for 5 days and successfully tested systems aboard both the orbital and descent module.[44] In keeping with the theme of Chinese human spaceflight for national honor, Wu Bangguo, China's top legislator, touted *Shenzhou* 6 success as, "improving China's international status, national strength, and mobilizing people around the communist party."[45] The success of *Shenzhou* 6 success was joined by *Shenzhou* 7 in 2007. This flight in particular received worldwide acclaim due to the successful completion of a spacewalk and the first launch of three taikonauts.[46]

Figure 35: Spacewalk of *Shenzhou* 7

Source: Chinese Space Agency, "China Completes First Spacewalk," http://english.china.com/zh_cn/news/china/11020307/20080927/15112672.html (Accessed 29 April 2011).

Each of these missions demonstrated a technological generation skip of technology. China's late arrival to human spaceflight has resulted in their ability to leverage existing technology to maximum benefit. However, China's emphasis on honor, combined with the eastern culture's obsession with preserving face, has resulted in a deliberately slow and secretive pace of launch operations. China's next generational skip mission, currently scheduled for mid to late 2011, will focus on the launch of a 19,000 pound scientific space station module Designated as *Tiangong*-1 (Celestial Bell) designated as *Tiangong*-1 (Celestial Bell). [47] Current plans call for taikonauts to take up residence

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[44] Erik Seedhouse, *The New Space Race*, 191.
[45] Erik Seedhouse, *The New Space Race*, 190.
[46] "Shenzhou 7," *Astronautix*, http://www.astronautix.com/flights/shezhou7.htm (Accessed 26 March 2011).
[47] Clara Moskowitz, "First Piece of Chinese Space Station Assembled for 2011 Launch," *Space.com*, 17 August 2010, http://www.space.com/8968-piece-chinese-space-station-assembled-2011-launch.html (Accessed 28 March 2011).

beginning in 2012.[48] In a further attempt at advancing national honor, China has proposed a moon mission to occur in the years from 2020 to 2025.[49]

Conclusions

In similar vein to the early space race programs of the Americans and Soviets, China has embarked on a serious human spaceflight agenda to advance state interests and pursue global honor. Understanding the unique history and motivations for China's space program helps to clarify several salient features for an American spacepower strategist.

First, China's human spaceflight efforts are primarily directed at advancing its own internal agenda. Unlike the early space race between the United States and the Soviet Union, there is no indication from the Chinese of a quest to defeat western style democracy. Nor is there any indication from the Chinese of a military human spaceflight program designed to carry out a doomsday nuclear mission against America. Instead, China's human spaceflight program is designed to enhance asymmetric space faring capabilities as a means to increase global competitiveness. For instance, advances made from the *Shenzhou* program and Long March family of boosters will provide spin off technologies, such as advanced space lift and tracking networks, useful for China's space warfare, technological development, and commerce strategies. Hence, China's human spaceflight program, while not an existential fear based threat to America, represents an enduring challenge to US national interests in terms of space leadership and

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[48] Clara Moskowitz, "First Piece of Chinese Space Station Assembled for 2011 Launch," *Space.com*, 17 August 2010, http://www.space.com/8968-piece-chinese-space-station-assembled-2011-launch.html (Accessed 28 March 2011).
[49] Erik Seedhouse, *The New Space Race*, 194.

overall global power. Hence, the rising competition from China should not be dismissed lightly.

Second, China's objective of landing taikonauts on the moon is a direct affront to America's crowning spaceflight achievement. However, entering into a direct competition with the Chinese to return to the moon would be a poor strategic move for America. In some regards, accepting such a challenge would be akin to the Soviet's ill-conceived decision to accept the moon race against the US in the 1960s in spite of larger strategic factors that cautioned otherwise. For example, if the United States won this competition against the Chinese, it would only prove that America can spend a tremendous amount of money to replicate an act first accomplished in 1969. If the United States lost this competition, the prestige ceded to China by the United States would be the death knell of America's human spaceflight program. In either scenario, the United States plays directly into the strategic trap laid by China; either way the United States loses. Instead, America should pursue its own objectives, such as flights beyond cis-lunar space, that the Chinese are either incapable of or uninterested in. China's flights to the moon could then be a boon for their own purposes, while the United States could continue to set the bar for space exploration leadership by reaching destinations far beyond the moon. This is the only viable approach to compete with the Chinese for international honor.

These developments come at a time of severe economic and political turmoil within America's human spaceflight program. From this perspective, America will need to reassess its approach to human spaceflight as a tool to enhance overall spacepower. A new strategy is needed to continue America's space leadership for the future.

Chapter 5

WHERE DO WE GO…WHERE DO WE GO NOW?
Crafting a Strategy to leverage human spaceflight capabilities for the future of US spacepower leadership

> *My position is that it is high time for a calm debate on more fundamental questions. Does human spaceflight continue to serve a compelling cultural purpose and/or our national interest? Or does human spaceflight simply have a life of its own, without a realistic objective that is remotely commensurate with its costs? Or, indeed, is human spaceflight now obsolete?*
>
> James Alfred Van Allen, 2004

The hallmark of sound strategy is harmonization across the spectrum of ends, ways, and means. In this definition, ends refer to the overarching objectives of a nation, ways refer to the methods used to accomplish strategic ends, and means define the available resources to support ways. Decoupling any one of these three elements from the others will result in a ruinous strategy that wastes precious resources or commits futile ways towards the achievement of ill-defined ends. Furthermore, successful strategy is both an art and a science; it requires a skillful blend of pragmatism and intuitive creativity. Too much emphasis on rote pragmatism results in dull, unimaginative, and relatively inflexible solutions to vexing and adaptive problems. On the contrary, a hyper-focus on creativity can result in fantasy-like solutions with no basis in reality. A strategist must walk a fine line of discernment to bridge the gap between the real and the possible.

With respect to the space program, sound strategy is especially vital given the traditionally long development times and cost of historical space programs. In particular, engendering broad political and popular

support for human spaceflight's role in American spacepower can only occur with a clear articulation of space strategy. From this perspective, geostrategic context is a preeminent variable in understanding the impact of Thucydides' notions of fear, interest, and honor upon human spaceflight development. Given the lessons of the previous 50 years of human spaceflight across three nations, lighting a clear pathway to link ends, ways, and means is especially important given today's murky geostrategic context.

The Ends of US Spacepower Strategy

American spacepower goals, as defined by the 2010 US National Space Strategy (NSS), include the invigoration of domestic competitive industries, expansion of international cooperation, strengthening of space operations stability and resilience, pursuit of human and robotic initiatives, and the enhancement of space-based Earth and solar observations.[1] The NSS further directs all US departments and agencies to strengthen US leadership both domestically and internationally in space and space related science, technology, and industrial efforts.[2] The 2010 National Security Space Strategy, military complement to the 2011 NSS, strongly reaffirms these goals, but also acknowledges the need to deter space aggression and protect capabilities in a degraded space domain.[3]

Overall, the broad and defuse nature of these American spacepower goals can seem confounding at first glance. For example, none of these goals point to a defined or quantifiable end state. It is impossible to define exactly when US capabilities have matured to the point where space aggression is deterred. How much expansion of international cooperation in space is enough? To what extent should

[1] National Space Strategy, 28 June 2010, 4.
[2] National Space Strategy, 28 June 2010, 5-6.
[3] National Space Security Strategy, January 2011, 1.

the United States pursue robotic versus human spaceflight? Furthermore, neither document is truly a "strategy" since they are silent about channeling ways and means towards the accomplishment of goals. As a result, many have criticized these documents for being too vague to provide much meaning.

However, a deeper analysis of these documents points to an important strategic undercurrent critical for the future of American spacepower. First, by loosely defining spacepower objectives according to ideals as opposed to measurable end states, the NSS and NSSS formally highlight America's ongoing commitment to the pursuit of space advantage irrespective of context or prevailing conditions. This approach allows for flexibility in ways and means and focuses on long-term adherence to desired set of behavior as opposed to transient short-term wins or loses. Second, these documents officially acknowledge the importance of a holistic approach using the abilities of both government and commercial industry to meet future challenges in space.

Hence, the ends of US space strategy provide great latitude for the distinctive contributions of human spaceflight to US spacepower. From Thucydides' standpoint, the American spacepower objectives proposed in the 2010 NSS are in direct harmony with his concepts of a state's pursuit of national interests and honor. Human spaceflight, given the analysis conclusions drawn from this research, is especially suited to help the advance of these two grand strategic goals. With regard to objectives presented in the 2011 NSSS, human spaceflight, in its current form, is ill suited for directly addressing spacepower goals based on Thucydides' notion of fear. However, spin-off technologies developed to support human spaceflight, such as efficient, reliable, and low-cost space lift, can provide significant enhancement to US national security capabilities. In addition, new human spaceflight innovations may emerge that challenge the current military spaceflight paradigm and

open fresh avenues for human spaceflight in national security applications. These insights are critical when evaluating the unique strategic ways available to support the ends of America's space strategy.

The Ways of US Spacepower Strategy

A government centric approach has dominated the first fifty years of human spaceflight. The United States, Russia, and China all adopted this model due to the tremendous uncertainties involved in spaceflight, national industrialization effort required to marshal resources and talent, and geostrategic implications of success or failure. In essence, all three nations adopted a technocratic approach as a means of directing resources towards the accomplishment of immediate and defined goals. However, this approach has also created an extensive bureaucratic infrastructure that is both expensive to maintain and relatively inflexible to rapid changes. Space programs under this architecture generally tend to rapidly balloon in cost and quickly exceed initial schedule estimates. Hence, space programs tend to become ripe political targets for cancellation. Human spaceflight programs, due to their added complexity, weight, and safety requirements over uninhabited vehicles, are especially susceptible to these adverse programmatic characteristics. As a result, the previous 20 years of human spaceflight development, from the vaunted National Aerospace Plane to the Constellation program, resemble a graveyard of lost dreams.

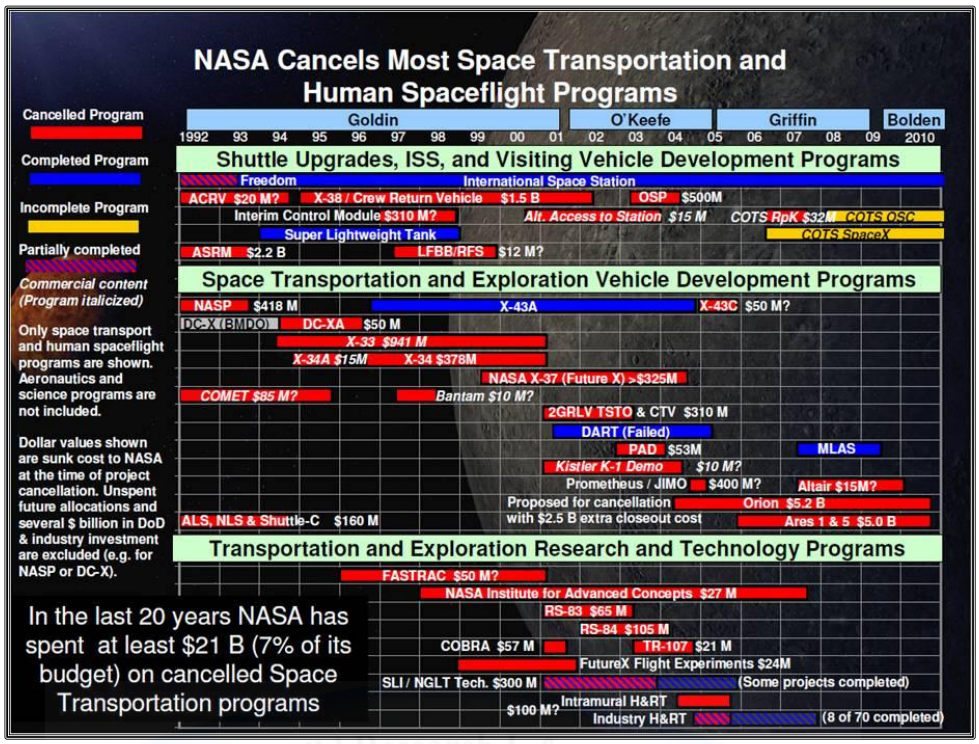

Figure 36: Cancelled Space Transportation and Human Spaceflight Programs of the Previous 20 Years

Source: Dr. Scott Pace, "A Review of NASA's Exploration Program in Transition: Issues for Congress and Industry," *Space Policy Institute*, 30 March 2011, http://www.gwu.edu/~spi/assets/docs/Pace_House_Testimony_033011.pdf (Accessed 28 April 2011).

The historical miasma associated with securing long-term political support, combined with today's context of dwindling state financial resources, has made the government centric approach to human spaceflight untenable. As per the 2010 NASA Authorization Act, the impending retirement of the Space Shuttle in the summer of 2011 will bookend America's 50 years of exclusive government control and direction of human spaceflight.[4] Instead, the United States will turn to a hybrid approach that seeks to use commercial and government human spaceflight to accomplish America's spacepower objectives.[5] In this model, government human spaceflight efforts will focus on accomplishing deep space exploration missions to Lagrange points and near-Earth objects while commercial companies focus on missions to

[4] *2010 NASA Authorization Act*, S.3729, 111th Cong., 2nd sess., (2010), 6.
[5] *2010 NASA Authorization Act*, S.3729, 111th Cong., 2nd sess., (2010), 7.

low Earth orbit[6]. Analysis of this new strategic approach to human spaceflight provides important insights into potential opportunities and pitfalls for the future of American spacepower.

Changing the strategic way of human spaceflight from a purely government system to a government and commercial hybrid partnership unfetters public and private sector organizations to focus on missions ideally suited to their unique structure and purpose. In accordance with objectives described in the 2010 National Space Strategy and the 2009 Augustine Commission presidential review of human spaceflight, deep space exploration missions are important as they help to expand the frontiers of science and engineering, encourage international participation and cooperation, and open new opportunities for resource exploitation.[7,8] However, these missions typically require complex operations associated with great risk and long epochs of technological development. These strategically important missions are uniquely suited for government as the great unknowns and high costs associated with them are tremendous disincentives for commercial spaceflight companies.[9] In turn, commercial companies will compliment government efforts by focusing on relatively low risk, short development time missions using simple and mature technology.[10] This frees precious government resources for more advanced spacepower uses, creates a viable new industry for space, and unleashes commercial competition as a means to create incremental technology advancements at greater speed and reduced cost than equivalent government efforts.

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[6] Review of US Human Spaceflight Plans Committee, *Seeking a Human Spaceflight Program Worthy of a Great Nation (2010),* 16.
[7] Review of US Human Spaceflight Plans Committee, *Seeking a Human Spaceflight Program Worthy of a Great Nation,* 9.
[8] National Space Strategy, 28 June 2010, 4.
[9] William Pomerantz (Virgin Galactic Vice President for Special Projects), interview by the author, 25 March 2011.
[10] William Pomerantz (Virgin Galactic Vice President for Special Projects), interview by the author, 25 March 2011.

In essence, the United States is in the process of relinquishing a pure technocratic approach to human spaceflight, implemented since the administration of President John F. Kennedy, and supplanting it with a middle ground approach between technocracy and *laissez-faire* style technological development. Given the current lack of a compelling geostrategic imperative to funnel human spaceflight efforts, such as the moon race against the Soviet Union, this shift in the ways of space strategy is appropriate and of potentially great benefit for the United States. As demonstrated by the early Russian and American approaches to aeronautical development during the Golden Age of Aviation, this emerging model of human spaceflight can unleash a surge of entrepreneurial innovation and greatly expand the spectrum of spacepower capabilities. As related by Phil McAlister, acting director of NASA's Commercial Human Spaceflight Division, the potential success of this way of strategy is enhanced over the previous era's graveyard of lost dreams by the development of several distinguishing contemporary factors.

First, the impending retirement of the Space Shuttle and cancellation of the follow on Constellation space program has effectively eliminated the mainspring of America's human spaceflight capability for many years.[11] The ominously large gap of time between the final Space Shuttle mission and first flight of the next generation US government spacecraft has created unprecedented incentive and opportunity for favorable government policy changes and demand for commercial low Earth orbit vehicles. Second, the US government's decision to extend funding and support for the ISS until at least 2020 closes the business case for commercial providers by providing, for the first time, a destination in space for the delivery of cargo and crew.[12] Third, 50 years

[11] Phil McAlister (NASA HQ), interview by the author, 22 March 2011.
[12] Phil McAlister (NASA HQ), interview by the author, 22 March 2011.

of government spaceflight in low Earth orbit has produced a tremendous trove of skill and technology.[13] This greatly reduces the technical risk for commercial companies since they can leverage this experience to emulate spaceflight technology that has been in existence since the 1960s. Last, the recent emergence of space tourism, and increasing demand for low cost, reliable, and routine access to space by foreign nations, the scientific community, and private businesses has created a broad customer base for commercial human spaceflight companies instead of a NASA monopsony.[14] This reduces overall business risk as it provides several revenue streams and multiple paths for development in the event demand from the US government slackens.

Additionally, the recent establishment of aerospace achievement financial prizes and incentives has accelerated the push for commercial human spaceflight innovation. These prizes mirror similar efforts conducted by both the government and wealthy private citizens during the Golden Age of Aviation to spur aerospace achievement. In 1919 for example, New York hotel magnate Raymond Orteig established a $25,000 prize for the first non-stop aircraft flight between New York and Paris.[15] Charles Lindbergh, a young and unknown airmail pilot at the time, would claim this prize eight years later and catapult to aviation fame with his legendary 33 ½ hour solo flight across the Atlantic ocean.[16] Nearly eight decades later, the Orteig prize became the inspiration for entrepreneur Peter Diamandis's X PRIZE; a $10 million award for the first non-government team to launch a three person capable sub orbital spacecraft above 100 kilometers twice within a two

[13] Phil McAlister (NASA HQ), interview by the author, 22 March 2011.
[14] Phil McAlister (NASA HQ), interview by the author, 22 March 2011.
[15] "Raymond Orteig - $25,000 prize," Charles Lindbergh: An American Aviator, http://www.charleslindbergh.com/plane/orteig.asp, (Accessed 20 March 2011).
[16] "Raymond Orteig - $25,000 prize," Charles Lindbergh: An American Aviator, http://www.charleslindbergh.com/plane/orteig.asp (Accessed 20 March 2011).

week time period.[17] This prize, renamed in 2004 as the Ansari X PRIZE after a multi-million dollar donation from entrepreneurs Anousheh and Amir Ansari, was awarded in October of 2004 to the Mojave Aerospace Ventures' SpaceShipOne project.[18] This team, a venture between Burt Rutan's Scaled Composites company and Microsoft Co-Founder Paul Allen, heralded a new era in human spaceflight in much the same manner that Lindbergh's flight revolutionized air travel.[19] In similar vein, NASA's financial incentives to private industry for milestones achievements under the ISS Commercial Crew Development program offer additional viability to the success of commercial human spaceflight. As stated by William Pomerantz, formerly of the Google Lunar X PRIZE foundation, the recent creation of highly publicized competitions for honor and financial awards have brought great legitimacy to commercial human spaceflight.[20] These endeavors also serve as a catalyst to bring together wealthy and willing investors with talented aerospace engineering teams.[21]

Figure 37: Members of the Mojave Aerospace Ventures Team Celebrate after the Ansari X PRIZE Winning Flight

Source: Jim Sugar, "Flying High-Private Space Flight," *National Geographic*, http://science.nationalgeographic.com/science/space/space-exploration/flying-high.html (Accessed 30 April 2011).

[17] Anousheh Ansari, *My Dream of Stars,* 76.
[18] Anousheh Ansari, *My Dream of Stars*, 94.
[19] Anousheh Ansari, *My Dream of Stars*, 94.
[20] William Pomerantz (Virgin Galactic Vice President for Special Projects), interview by the author, 25 March 2011.
[21] William Pomerantz (Virgin Galactic Vice President for Special Projects), interview by the author, 25 March 2011.

However, unlike the pioneers of the Golden Age of Aviation, contemporary human spaceflight entrepreneurs face a gauntlet of legal and liability obstacles equally as challenging as any technical barrier. In today's litigious society, defining the rules of legal liability for accidents involving commercial human spaceflight vehicles continues to be a major challenge for this emerging industry.[22] In addition, legacy principles under the 2010 US State Department's International Traffic in Arms Regulations (ITAR) hobble the competitive efforts of American commercial human spaceflight companies to recruit top talent and harness the best materials. The provisions of ITAR, originally designed as a means to control the export and import of defense related articles, broadly classifies any American technology relating to space launch vehicles as a non-releasable state controlled item.[23] The strict interpretation of this regulation originates from a February 1996 incident in which the US State Department charged Loral Systems with violating the Arms Export Control Act.[24] Government officials alleged an illegal transfer of technology occurred once western engineers aided Chinese accident investigators following the failed launch of a Long March booster carrying a US telecommunications satellite.[25] As identified in the National Space Strategy, stemming the flow of advanced space technology to unauthorized parties will continue to be a top priority of the US government.[26] However, given the sweeping changes in commercial human spaceflight that have occurred in intervening 15 years since the Long March incident, a review of ITAR policy is warranted to streamline and clarify which classes of space technology

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[22] Frank Culbertson and Bob Richards (Orbital Sciences), interview by the author, 21 March 2011.
[23] US State Department, *International Traffic in Arms Regulations* (Washington, DC, 1 April 2010), Part 121.
[24] *US National Security and Commercial Concerns with the People's Republic of China,* 105-851, 105th Cong., 2nd sess., (2010), 96.
[25] *US National Security and Commercial Concerns with the People's Republic of China,* 105-851, 105th Cong., 2nd sess., (2010), 96.
[26] National Space Strategy, 28 June 2010, 8.

are truly advanced and national security controlled, and which are commonplace and sharable with foreign nationals.

Despite these pitfalls, a hybrid government and commercial approach as a way of accomplishing the objectives of US spacepower strategy is a viable approach given today's contextual factors. This approach appeals to the unique abilities of American entrepreneurship and strengths of government human spaceflight. In this context, the utility of human spaceflight in building the link between strategic ends and ways is important when evaluating the available means proposed by government and commercial human spaceflight actors.

The Means of US Spacepower Strategy

The next fifty years of human spaceflight will look dramatically different from the first fifty years. The birth of a hybrid government and commercial system will prove a daunting challenge. However, a slew of proposals from leading actors within the government and commercial human spaceflight industry offer a glimpse into the future means of American spacepower leadership. In similar vein to the Golden Age of Aviation, US government agencies from the DOD to NASA, can utilize the most promising of these technologies via a fast adopter, rather than state directed, approach. Current efforts by commercial and government human spaceflight organizations are seeking to advance space technologies across the spectrum from space lift, deep spaceflight, orbital, and suborbital operations. Progress along these fronts will greatly advance state objectives proposed in the US National Space Strategy and National Security Space Strategy at a fraction of the cost of the old technocratic paradigm. Rather than hollow companies with flashy websites and fanciful proposals, several actors of this emerging commercial human spaceflight industry have become serious technical contenders worthy of state attention.

For example, SpaceX, a company founded in June 2002 by PayPal billionaire Elon Musk, is the current orbital spaceflight leader for commercial human spaceflight.[27] A cornerstone of SpaceX's success is their development of the Merlin engine; a liquid fueled engine that serves as the propulsion source for SpaceX's family of boosters.[28] Using a Falcon 1 booster powered by a single Merlin engine in the first stage, SpaceX achieved notoriety on 28 September 2008 by becoming the first private organization to launch a liquid fueled rocket into orbit.[29] The success of the Falcon 1 series of flights paved the way for Falcon 9; a significantly larger booster powered by nine Merlin engines in the first stage.[30] In July of 2010, Falcon 9 successfully achieved orbit on its maiden launch. Subsequently, Falcon 9 became the booster for the historic launch, orbit, and recovery of SpaceX's prototype Dragon capsule in December of 2010.[31]

Figure 38: Falcon 9 with Prototype Dragon Capsule Launches from Cape Canaveral on 8 December 2010

Source: Gary I Roth, *MSNBC* http://www.msnbc.msn.com/id/37989073/ns/technology_and_science-falcon_9?q=Falcon%209 8 December 2010 (Accessed 29 April 2011).

Upon achieving operational status, the Dragon capsule will feature two variants, one for cargo and one for crew, and will initially

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[27] Jamie Hadden, Ken Bowersox, Garret Reisman (SpaceX), interview conducted by the author, 27 March 2011.
[28] Jamie Hadden, Ken Bowersox, Garret Reisman (SpaceX), interview conducted by the author, 27 March 2011.
[29] Jamie Hadden, Ken Bowersox, Garret Reisman (SpaceX), interview conducted by the author, 27 March 2011.
[30] Jamie Hadden, Ken Bowersox, Garret Reisman (SpaceX), interview conducted by the author, 27 March 2011.
[31] Jamie Hadden, Ken Bowersox, Garret Reisman (SpaceX), interview conducted by the author, 27 March 2011.

serve as a vehicle to service the ISS under NASA's Commercial Crew Delivery program.[32] However, the company envisions using the Dragon and Falcon 9 combination to perform a variety of future missions including space tourism, DOD support, and service to commercial space stations.[33] Future proposals call for the development of Falcon 9 Heavy, a booster capable of lifting twice the payload of Delta IV Heavy, and a vertical landing version of the Dragon capsule, a spacecraft capable of delivery of cargo and crew to virtually any destination on the planet.[34] With respect to US spacepower ends and ways, the addition of the Falcon family of boosters provides a greater variety of space-lift launch options, fuels competition with the Delta and Atlas series of rockets, and helps to drive down launch cost to orbit. As encouraging proof of this potential, a 2011 NASA report to congress estimates that it would cost the US government an estimated $1.7 to $4 billion to perform the same mission with a Falcon 9 equivalent program that costs SpaceX $390 million.[35] The tremendous gulf in costs, derived using a NASA-Air Force cost parametric tool that references a database of 130 historical government spaceflight projects, owes to the differences in overhead and bureaucracy between government and commercial industry.[36,37]

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[32] Jamie Hadden, Ken Bowersox, and Garret Reisman (SpaceX Mission Assurance), interview conducted by the author, 27 March 2011.
[33] Jamie Hadden, Ken Bowersox, and Garret Reisman (SpaceX Mission Assurance), interview conducted by the author, 27 March 2011.
[34] Jamie Hadden, Ken Bowersox, and Garret Reisman (SpaceX Mission Assurance), interview conducted by the author, 27 March 2011.
[35] Frank Morring Jr., "Panelist: SpaceX Costs Offer Hope for NASA," *Aviation Week and Space Technology*, 20 May 2011, http://www.aviationweek.com/aw/generic/story_channel.jsp?channel=space&id=news/asd/2011/05/19/01.xml&headline=Panelist:%20SpaceX%20Costs%20Offer%20Hope%20For%20NASA (Accessed 21 May 2011).
[36] Frank Morring Jr., "Panelist: SpaceX Costs Offer Hope for NASA," *Aviation Week and Space Technology*, 20 May 2011, http://www.aviationweek.com/aw/generic/story_channel.jsp?channel=space&id=news/asd/2011/05/19/01.xml&headline=Panelist:%20SpaceX%20Costs%20Offer%20Hope%20For%20NASA (Accessed 21 May 2011).
[37] Dallas Bienhoff (Boeing In-Space and Surface Systems), interview by the author, 21 March 2011.

The combined team of Scaled Composites and Virgin Galactic lead the suborbital human spaceflight industry. Their suborbital space plane, SpaceShipTwo, is a significantly larger, robust, and capable operational progenitor of the original SpaceShipOne; winning vehicle of the Ansari X PRIZE.[38] In addition to serving space tourism passengers, SpaceShipTwo will perform scientific and bio-medical microgravity research missions.[39] Of particular interest to the DOD, WhiteKnightTwo, the carrier platform for SpaceShipTwo, can potentially fulfill a niche strategic market as an atmospheric launch platform for micro satellite and small space planes.[40] In this capacity, WhiteKnightTwo can support the military's long-standing quest for a truly operationally responsive space lift capacity.

Figure 39: White Knight Two Carrier Aircraft with Space Ship Two Space Plane

Source: Mark Greenberg, Virgin Galactic's VSS Enterprise Makes First Captive Carry Flight," *SpacePlex*, 22 March 2010, http://spaceplex.com/2010/03/22/virgin-galactics-vss-enterprise-makes-first-captive-carry-flight/ (Accessed 30 April 2011).

From the perspective of Scaled Composites and Virgin Galactic, providing cheap, reliable, and routine access to space for all citizens will create the foundations of a truly space-minded and space faring society.[41] Fielding SpaceShipTwo will serve as a foundational step in the long-term development of innovative suborbital spaceflight technologies, such as point-to-point global travel.

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[38] Mark Stucky and Matt Stinemetze (Scaled Composites), interview conducted by the author, 26 March 2011.
[39] Mark Stucky and Matt Stinemetze (Scaled Composites), interview conducted by the author, 26 March 2011.
[40] Mark Stucky and Matt Stinemetze (Scaled Composites), interview conducted by the author, 26 March 2011.
[41] Mark Stucky and Matt Stinemetze (Scaled Composites), interview conducted by the author, 26 March 2011.

XCOR, makers of a family of lightweight and efficient liquid fueled rocket engines as well as the EZ-Racer and X-Racer rocket powered aircraft, is developing the Lynx; a space plane that will perform similar space tourism, microgravity research, and microsatellite launch booster suborbital missions as SpaceShipTwo.[42] However, rather than air launching from a carrier platform, Lynx will self-launch from a runway like a conventional aircraft.[43] This concept of operations greatly reduces complexity, improves operational flexibility, and provides niche military application.

Figure 40: XCOR's Lynx Space plane Concept with External Payload Fairing

Source, *XCOR*, http://www.xcor.com, (Accessed 1 May 2011).

XCOR envisions a unique spot responsive military surveillance mission for the Lynx.[44] Under a concept known as virtual persistence, a Lynx space plane outfitted with an electro-optical package, electronic collections sensors, or radar-mapping pod could use its runway launch flexibility and suborbital apogee to provide flexible strategic surveillance of hostile nations with non-permissive air environments. In this capacity, Lynx could add to the available options for national security surveillance spaceflight. In addition, Lynx's launch and reentry profile mimics that of ballistic missiles. Because of this capability, Lynx can

[42] Aleta Jackson and Eric Anderson(XCOR), interview conducted by the author, 26 March 2011.
[43] Aleta Jackson and Eric Anderson (XCOR), interview conducted by the author, 26 March 2011.
[44] Rick Searfoss (XCOR), interview conducted by the author, 26 March 2011.

also serve as a surrogate target for rapid testing and fielding of ballistic missile defense radar tracking and targeting systems.[45]

Finally, Lockheed Martin's contract to NASA for the development of the Orion spacecraft under the Multi Purpose Crew Vehicle (MPCV) program continues despite the cancellation of the original Ares boosters and moon mission of the Constellation program. Instead, the Orion will explore destinations beyond cis-lunar space, such as asteroids. [46] Under Thucydides definitions, these missions are designed to bolster US honor and spur technical prowess based national interest objectives. Through international partner collaboration, human space exploration missions of the future will also help foster America's diplomatic, cultural, and political interests objectives described in the 2010 National Space Strategy. As such, Orion will enhance American soft power in much the same manner as the ISS does today. In addition, Orion's exploration of asteroids in a planned progression towards ultimate missions to Mars can also provide data crucial for planetary defense against impacts from near Earth objects.[47] In this light, human spaceflight under the MPCV program provides a unique global security benefit. Such missions will help humankind achieve its ultimate space objective; the spread of

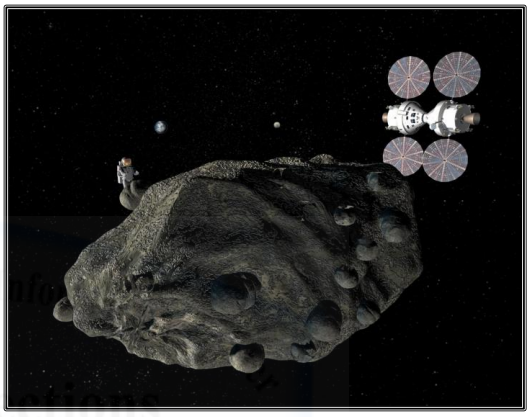

Figure 41: Artist Conception of the Multi Purpose Crew Vehicle Orion performing an Asteroid Mission

Source: "Orion," *Lockheed Martin*, 22 March 2010, http://www.lockheedmartin.com/products/Orion/index.html (Accessed 3 May 2011).

[45] Aleta Jackson and Eric Anderson (XCOR), interview conducted by the author, 26 March 2011.
[46] Randy Sweet, Eric Hogan, and Vanessa Aponte (Lockheed Martin), interview conducted by the author, 30 March 2011.
[47] Randy Sweet, Eric Hogan, and Vanessa Aponte (Lockheed Martin), interview conducted by the author, 30 March 2011.

human life to planets other than Earth. From these perspectives, space exploration maintains much greater state benefit than just the pursuit of knowledge as an end unto itself. Instead, human space exploration can hold the keys to answer the greatest of existential threats to state power; that of the ultimate survival of the human race.

Conclusions

Professor James Van Allen, discoverer of the Van Allen radiation belt, was always a great opponent of human spaceflight. In his estimation, human spaceflight was far too expensive for the benefits achieved. He argued that governments should instead spend resources on robotic exploration and surveillance spacecraft. He even went so far as to charge that human spaceflight was becoming obsolete. In a strange sense, Professor Van Allen was both correct and incorrect.

As stated aptly in the opening lines of the 2009 Augustine Commission presidential report on human spaceflight, "The U.S. human spaceflight program appears to be on an unsustainable trajectory. It is perpetuating the perilous practice of pursuing goals that do not match allocated resources."[48] In this light, human spaceflight, under the old government directed technocratic paradigm, was in danger of becoming a fiscal morass. The current US economic and political environment threatened to prove Professor Van Allen correct.

However, crisis offers a moment fraught with both danger and an excellent opportunity for positive change. In a paradoxical twist to Professor Van Allen's beliefs, uninhabited spaceflight benefits from a robust human spaceflight program. Frank Culbertson, retired US Navy Captain, former astronaut, and current vice president for Orbital Science's Advanced Program Group, best summarized the reason for

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[48] Review of US Human Spaceflight Plans Committee, *Seeking a Human Spaceflight Program Worthy of a Great Nation,* 9.

this when he stated, "There will always be something inspirational about the human presence in space. People identify with people who fly in space because that connection puts the rest of the human population into space."[49] Therefore, human spaceflight is distinctive in that it generates a powerful undercurrent of inspiration useful for bolstering a nation's overall efforts in space, whether human or uninhabited. This human spaceflight factor accelerates the overall technical prowess required for a state's use of Thucydides' concepts of power. The value of human spaceflight to a state is therefore of much greater significance than indicated by Professor Van Allen. The inspiration of human spaceflight, when combined with the concepts of state power, is a potent force for grand strategy.

In addition, the emerging hybrid partnership between government and commercial entities prove that human spaceflight is far from obsolete. Instead, this new paradigm represents a viable way for the achievement of space strategy ends using realistic means. Innovations within an emerging US commercial human spaceflight industry offer spacepower strategists advanced capabilities at significant cost savings. National leadership's support of these nascent technologies is crucial for the viability of American state power. Amidst the current environment of austere economic and political state resources, this is the only spacepower strategy capable of advancing US space leadership into the future.

[49] Frank Culbertson (Orbital Sciences), interview by the author, 21 March 2011.

Chapter 6

CONCLUSIONS

From the past…the future.

> *The bottom line is nobody is more committed to manned space flight, to the human exploration of space than I am, but we got to it in a smart way, can't be doing the same old things we have been doing by doing it the old way.*
>
> President Barack Obama, 2011

Over the span of human history, the wisdom of Thucydides rings as true today in Earth orbit as it did 2500 years ago in the Peloponnesian wars between Athens and Sparta. The powerful motivators of fear, interest, and honor continue to serve as the guiding hand behind state behavior. With respect to the space age, the first fifty years of human spaceflight are a particularly noteworthy demonstration of Thucydides' concepts. Geostrategic complexities, technical challenges, the specter of risk, and staggering financial costs have meant that nations embarking on human spaceflight as a tool of grand strategy only do so out of an especially compelling need to satisfy these timeless goals. The quest to surmount these obstacles burnishes the international significance and exclusivity achieved once nations develop human space faring capabilities. Human spaceflight gives nations added leverage in achieving state goals. In addition, the achievement of human spaceflight bolsters a state's overarching space faring technical prowess and serves as a tremendous source of societal inspiration. Understanding the utility of human spaceflight in addressing Thucydides' concepts of state power and achieving grand strategic goals is important for the viability of US spacepower. A brief survey of the major human spaceflight exploits of the United States, Russia, and China provides key insights and lessons for ensuring the future of America's space leadership.

Human Spaceflight Lessons for Addressing State Fears

Abject fear was undoubtedly a powerful motivator for the development of human spaceflight. Within Russia, national security concerns drove the development of *Raketoplan*, *Almaz*, and *Buran*. For the United States, national security concerns were evident in the designs for Dyna-Soar, Manned Orbiting Laboratory, and many aspects of the initial Space Shuttle program. For both nations, the need to support Détente's efforts to defuse doomsday fears drove the ethos behind the celebrated Apollo-*Soyuz* Test Project. Finally, the genesis of Chinese human spaceflight traces its lineage to deep-seated regional nuclear war fears. Therefore, whether it was the dread of annihilation from nuclear attack, or panic over worries of strategic technological surprise during the Cold War, the dynamic of fear carved a special military dynamic to the history of human spaceflight.

Overall, the lessons from these programs highlight the checkered utility of human spaceflight for national security. Nations initially turned to human spaceflight as a means of protection as they viewed space as the natural extension of the air environment. Advanced space bombers and futuristic celestial fighter craft would eventually supplant their atmospheric based cousins in the pursuit for control of the high ground of space. However, the excessively high costs, operational limitations, and extended development time of human spaceflight projects have greatly diminished a human's direct role in space for military purposes, regardless of technical merit. When coupled with the sweeping pace of automation and technology advances, the rational case for human spaceflight in national security becomes bleak. Specifically, advances in ICBM capabilities and enhancements in early warning technology quickly obviated the case for the kinetic missions of Dyna-Soar and *Raketoplan*. Neither vehicle ever developed beyond scale model testing. Furthermore, astounding improvements in satellite

observation capabilities during the 1960s and 1970s rang the death knell for Manned Orbiting Laboratory on the drawing board and *Almaz* after only three flights. The use of the Space Shuttle as an operational military spaceplane for such missions as orbital nuclear bombardment or satellite disruption proved severely overestimated given the Shuttle's ponderous launch and recovery procedures and extreme cost. While astronauts performed several military surveillance experiments on orbit using the Space Shuttle, none achieved success practical for operational utility. In addition, Atlas and Delta boosters supplanted the Shuttle's role in launching classified payloads for the DOD and National Reconnaissance Office (NRO) following the Challenger disaster. The military saga of *Buran,* the Soviet equivalent to the Space Shuttle, was stillborn after only one uninhabited test flight due to the Soviet's gross lack of understanding of the geostrategic environment, poor development decisions, and pervasive economic and political instability. In a bizarre twist, the ruinous shock to the Soviet economy caused by the frantic rush to develop *Buran* in response to the Space Shuttle was perhaps the greatest military impact caused by any human spaceflight program.

Last, the Apollo-*Soyuz* Test Project demonstrated that harmony in space does not guarantee harmony on Earth. The sweeping success of the Apollo-*Soyuz* Test Project and global goodwill generated by the handshake seen around the world were not sufficient to counter overarching Cold War security fears. Within a few years of this space triumph, Cold War relations between the United States and Russia froze to new depths.

Despite this spotted legacy, military human spaceflight programs receive credit for greatly pushing the state of the art of space technology. For example, lessons learned from the Soviet *Almaz* program helped advance the design for later *Salyut* stations, and space station *Mir*.

Arguably, experience with *Almaz* helped cement the Soviet's reputation for expertise in long duration spaceflight technology. In similar fashion, experience with the Dyna-Soar and its predecessor, the X-15, provided useful technologies for the Space Shuttle; the backbone of US spaceflight for the previous 30 years. China's human spaceflights aboard the Long March family of boosters is paving the way for the next generation of advanced medium and heavy lift Chinese boosters. These boosters will support China's long-term commercial, military, and scientific goals.

Today's world of military spaceflight represents an amalgam of the visions presented by Generals Hap Arnold and Curtis LeMay. From General Arnold's standpoint, technology in the form of the Global Positioning System (GPS), communications satellites, and space based surveillance systems from the NRO and the United States Air Force have revolutionized command and control and intelligence gathering in warfare. From General LeMay's standpoint, human judgment, albeit exercised remotely from ground control stations, remains critical for the effective use of these capabilities in combat. Political sensitivities to space based weapons, a viable stockpile of ICBMs, and amazing advances in the capabilities and precision of conventional munitions preclude the need for crewed space bombers and orbital weapon space stations. While space based intelligence, surveillance, and reconnaissance will continue to be crucial for the nation's defense, remotely operated systems currently perform these missions at much reduced cost and greatly improved effectiveness in relation to their human spaceflight analogs.

Hence, the utility of human spaceflight as a tool to satisfy state fears have waned significantly from the early days of the space race. Rapid advances in technology and extensive changes in the geostrategic context make investments in human spaceflight for direct military

purposes unwise given current capabilities and the government focused paradigm of spaceflight.

However, recent shifts in human spaceflight development from a purely state directed technocratic focus to a hybrid government and commercial system offer the possibility to dramatically reduce cost and substantially increase the availability of access to space. This development would fundamentally alter the human spaceflight dynamics of the old order and would have tremendous impact to military applications. For example, SpaceX's Falcon 9 booster, primarily designed as a human rated rocket, also has the capability to launch uninhabited payloads at a fraction of the cost of traditional Delta and Atlas boosters. Furthermore, Virgin Galactic's WhiteKnightTwo carrier ship and XCOR's Lynx space plane offer the potential for simple, cheap, and responsive space lift and surveillance capabilities. The government, via a fast adopter approach, may benefit substantially from these technologies for military spaceflight.

Human Spaceflight Lessons for Garnering Honor

Leveraging human spaceflight as a means to garner international honor continues to be a major incentive for nations pursuing human spaceflight. The pursuit of honor was especially powerful during the opening days of the space race. Technological space prowess was a powerfully symbolic representation of the strength of either communism or democracy. In this context, the fate of the free world flew aboard American rockets as much as the promise of a socialist utopia flew aboard Soviet rockets. Astronauts and cosmonauts became modern day high frontier warriors in the battle of ideologies.

In the United States, the flights of Mercury, Gemini, and Apollo bore the mantle of American honor. For the Soviets, *Vostok*, *Voshkod*, and early *Soyuz* human spaceflight programs challenged the Americans

for the supremacy of ideology. During this same era, the Chinese sought global honor for Sino-style communism through the efforts of Project 714 and the *Shuguang* space capsule.

In recent times, following the implosion of communism in the early 1990s, the nature of honor morphed from a battle for ideological supremacy to nostalgic pride in national core values. For instance, leadership in spaceflight has become something uniquely American, while continued presence in long duration human spaceflight has become something uniquely Russian. The independent ability to fly humans in space has become the fierce hallmark of what it means to be Chinese. This reflective shift in honor was evident in the United States by the national mourning and resurgent feelings of American patriotism following the wake of the Challenger and Columbia disasters. This pride is also currently visible in the public outpouring of attention to the final flights of the Space Shuttle program. For the Russian public, pride in the Soviet legacy of human spaceflight achievement became apparent by the mass outcry of scorn following the decision to de-orbit space station *Mir*. For China, Yang Liwei's flight aboard *Shenzhou* 5 became an instant unifying symbol of national pride for China's desperate population. Clearly, the grand strategic allure of honor continues to inspire human spaceflight development.

However, while national honor is important, it cannot be the sole sustainer of a human spaceflight program. Honor is extraordinarily fleeting and entirely dependent on the changing whims of the geostrategic context. For example, the honor garnered by the triumphant Apollo moon missions was insufficient to sustain American space exploration in the face of vicious wars and a constrained fiscal environment. Furthermore, victory in the space race against the Soviets in 1969 did not have the visceral ideological impact hoped by President John Kennedy in 1961. Khrushchev's insatiable desire for honor fed an

irrational push for compensatory symbolism that bankrupted technological substance. Additionally, pride in Soviet historical space achievements could not save the Russian space program from being the primary target for tremendous budget and personnel cuts during the turmoil of the 1990s. A similar challenge currently awaits the American space program upon the conclusion of the Space Shuttle program.

Hence, honor is a necessary, but not sufficient, condition for sustaining a viable human spaceflight program. These lessons are important in creating a strategy for the future of American spacepower leadership given the significance of human spaceflight for achieving national interests.

Human Spaceflight Lessons for Advancing Interests

The pursuit of national interest encompasses a state's quest for advantage, profit, and benefit. In this regard, the grand strategic tool of human spaceflight has provided leverage to enhance political influence, achieve a measure of scientific and societal progress, and help economic gain. Specific human spaceflight programs designed to address national interests include America's Space Station Freedom project, Russia's *Salyut* stations, China's *Shenzhou* capsules, America's proposed MPCV spacecraft, and the international partnerships generated under the Shuttle-*Mir* and International Space Station programs.

President Ronald Reagan's desire to isolate the Soviet Union, politically shore up western alliances, and advance America's technical prowess drove efforts for the development of Space Station Freedom. Unfortunately, lackluster political support beyond the White House, haphazard program management, and ballooning financial costs caused Space Station Freedom to suffer a tortuous demise under endless redesign initiatives. Nonetheless, the ashes of Space Station Freedom provided the necessary political and technical experience required for

the design and creation of the International Space Station; a successful tool of US diplomatic soft power.

In similar fashion, the missions of the *Salyut* 6 and 7 space stations provided a means for the Soviet Union to bolster unity amongst the Warsaw Pact nations, advance Russian influence across a global network of communist states, and reap financial gain from neutral or western allied nations. The unique two docking port design of these space stations allowed the Soviets to maintain long duration *Salyut* missions simultaneous with short ambassador flights for foreign nation guest cosmonauts. Under this arrangement, states as disparate as Czechoslovakia, India, Vietnam, Afghanistan, Cuba, and Great Britain, collaborated with the Soviet Union in human spaceflight for the hope of advancing political, scientific, or diplomatic national interest.

The Shuttle-*Mir* and International Space Station partnerships with Russia were born from a desire to enhance geostrategic relationships following the collapse of the Soviet Union. Stemming the tide of nuclear proliferation, opening lucrative markets for trade with a former enemy, and providing economic and diplomatic support for the fragile governments of the new Commonwealth of Independent States made human spaceflight a viable tool to advance global national interests. While technical accidents, cultural misunderstandings, and botched obligations strained relationships, the successful completion of the Shuttle-*Mir* program and ongoing global partnerships under the International Space Station program are testament to the significance of achieving national interest.

Recently, spaceflight has also provided a means to generate wealth for states under an emerging commercial space tourism industry. Space station *Mir* and the International Space Station have both been host to several wealthy space tourists from multiple nations. Tens of

millions of dollars have been generated by contracts between private citizens and the Russian Space Agency in support of these commercial flights to orbit. Within America, the competition for wealth between several emerging human spaceflight companies promises to create a new space industry. For example, proposed human spaceflight programs by Virgin Galactic, SpaceX, and XCOR have the potential to usher in a new era of low cost, reliable access to space for the masses. The overall commercial benefits to the United States may be substantial.

This brief synopsis highlights several important lessons from the past with respect to human spaceflight's role in fulfilling state interests. First, using human spaceflight to advance national interests can succeed only if space efforts are undergirded by sound ethical principles and state behavior on Earth. In similar fashion to the national security lessons learned from the Apollo-*Soyuz* Test Project, success in space cannot guarantee the success of Earth bound national interest. For instance, Soviet efforts through its *Salyut* guest cosmonaut program could not strengthen the global efficacy of communism or prevent the collapse of the Soviet Union. Flights of an Afghani cosmonaut did not remedy the corruption of the Soviet invasion of Afghanistan.

Second, using human spaceflight as a means to bolster national interest can be successful, but can also come at a high price. States should wage international human spaceflight partnerships for the achievement of political and soft power goals, not for any perceived improvements in financial cost, technical performance, or schedule gains. To the contrary, experience from Space Station Freedom, Shuttle-*Mir*, and the ISS demonstrate international partnerships negatively influence the cost, schedule, and performance of a program due to vast increases in requirements and the tremendous difficulties inherent in coordinating and integrating technical efforts from multiple nations.

Last, human spaceflight, despite these realities, continues to maintain a unique ability to inspire generations towards nationally vital careers in STEM. The excitement and adventure generated by human spaceflight is even sufficient to foster a nascent space tourism industry capable of generating commercial wealth for states. These characteristics hint at the future utility of human spaceflight as an implement of national grand strategy.

The Way Forward

Human spaceflight can have great utility to a state's quest to address state fear, advance interest, and garner honor. The previous 50 years of human spaceflight have demonstrated the unique strengths of weaknesses of human spaceflight in spacepower. Throughout this time, America has maintained overall global space leadership. However, recent challenges to America's space leadership have emerged due to a tremendously constrained economic and political environment, as well as increased competition from nations such as China. Shifting American space strategy from a purely technocratic to a hybrid strategy between technocracy and *laissez-faire* style development offers a viable way to achieve spacepower ends. This approach, with respect to human spaceflight, leverages the unique strengths of both the government and commercial industries. Recent advances in technology spanning the gamut from suborbital to deep spaceflight provide a unique wellspring of resources to support the strength of America's overall spacepower. In much the same way as aviation during the Golden Age of Aviation, the US government can benefit greatly by adapting the most promising of these technologies via a fast adopter approach. Amidst the current environment of austere economic and political state resources, this human spaceflight partnership between government and commercial entities provides harmony across spacepower ends, ways, and means.

This strategy offers the best chance of achieving US space leadership for the future.

Implementing this strategy will not be easy, however few changes of this scale have ever been successfully implemented without struggle. In this light, the insight of Niccolo Machiavelli, famed 16th century advisor to the Florentine leadership of Italy, offers a future space strategist wise advice.

> It must be considered that there is nothing more difficult to carry out, nor more doubtful of success, nor more dangerous to handle, than to initiate a new order of things. For the reformer has enemies in all those who profit by the old order, and only lukewarm defenders in all those who would profit by the new order, this lukewarmness arising partly from fear of their adversaries, who have the laws in their favor; and partly from the incredulity of mankind, who do not truly believe in anything new until they have had the actual experience of it.[1]

[1] Niccolo Machiavelli, The Prince (New York, NY: New American Library, 1952), book 6.

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